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CONTENTS

VOL. XCVII.—YEAR 1934.

Part I, 1934.

	PAGES
On some Points relating to Vital Statistics, more especially Statistics of Occupational Mortality. By G. UDNY YULE, C.B.E., M.A., F.R.S., Fellow of St. John's College, Cambridge.....	1—72
Discussion on the Paper	73—84
Interpretation of the Statistics of Unemployment. By J. A. DALE, C.B.E.....	85—101
Discussion on the Paper	101—113
Miscellanea :—	
Recent Advances in Mathematical Statistics (1932). By J. O. IRWIN, M.A., D.Sc.	114—154
Indian Agricultural Statistics. By H. SINHA, Ph.D.; Calcutta University	155—162
Reviews of Books	163—187
Current Notes	188—211
Obituary: SIR EDGAR HARPER	212
Statistical and Economic Articles in Recent Periodicals...	213—220
Additions to the Library	221—232
Periodical Returns: Revenue; Trade of the United Kingdom; Bank of England Weekly Returns; Foreign Exchange	233—240

Part II, 1934.

The <i>Economist</i> Index of Business Activity. By GEORGE FREY CROWTHER, M.A.	241—261
Discussion on the Paper	261—276

	PAGES
Exchange Stability <i>versus</i> Internal Price Stability. By PROFESSOR J. H. JONES, M.A.....	277—299
Discussion on the Paper	299—312
Wholesale Prices in 1933. By the EDITOR of <i>The Statist</i>	313—330
Miscellanea :—	
Improvement of Curves fitted by the Method of Moments. By W. PALIN ELDERTON, C.B.E., F.I.A., and G. H. HANSMANN, Ph.D.	331—333
Reviews of Books	334—355
Current Notes	356—371
Statistical and Economic Articles in Recent Periodicals...	372—379
Additions to the Library	380—388
Periodical Returns : Trade of the United Kingdom (by countries); Registration of the United Kingdom.....	389—398
<i>Part III, 1934.</i>	
India's Trade and Industrial Statistics, Past, Present, and Future. By SIR H. A. F. LINDSAY, K.C.I.E., C.B.E., I.C.S.....	399—411
Discussion on the Paper	412—422
Methods used in Different Countries for Estimating National Income. By SIR JOSIAH STAMP, G.B.E., LL.D., D.Sc., F.B.A.	423—455
Discussion by PROFESSORS VERRIJN-STUART and F. SIMIAND, MR. A. W. FLUX, and PROFESSOR C. GINI	455—466
The Centenary of the Royal Statistical Society	467—472
The Twenty-second Session of the International Statistical Institute. By A. L. BOWLEY, Sc.D., F.B.A.	473—477
Miscellanea :—	
Internal Price Stability <i>versus</i> Exchange Stability. A note on Professor J. H. Jones's Paper. By DR. ROBERT EISLER	478—483
Reviews of Books	484—514

	PAGES
Current Notes	515—529
Statistical and Economic Articles in Recent Periodicals...	530—535
Additions to the Library	536—540

Part IV, 1934.

Discussion on Methods used in Different Countries for Estimating National Income. Continued by PRO- FESSOR A. L. BOWLEY and others	541—557
On the Two Different Aspects of the Representative Method: the Method of Stratified Sampling and the Method of Purposive Selection. By JERZY NEYMAN	558—606
Discussion on the Paper	607—625

Miscellanea :—

Pre-War Fluctuations of Profits in the Cotton Spinning Industry. By H. CAMPION	626—632
Value of Remittances Abroad for Cinematograph Films. By S. ROWSON, M.Sc.	633—640
Annual Report of the Council	641—653
Proceedings of the One Hundredth Annual General Meeting	654—657
Reviews of Books	658—678
Current Notes	679—692
Obituary: HENRY RAMIE BEETON	693—694
Statistical and Economic Articles in Recent Periodicals...	695—700
Additions to the Library	701—705
Annual List of Periodical Publications Received	706—719
Index to Vol. XCVII (1934)	720—724

JOURNAL
OF THE ROYAL STATISTICAL SOCIETY
PART I, 1934.

ON SOME POINTS RELATING TO VITAL STATISTICS, MORE
ESPECIALLY STATISTICS OF OCCUPATIONAL MORTALITY.

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John's College, Cambridge.

[Read before the Royal Statistical Society, November 21st, 1933,
PROFESSOR M. GREENWOOD, F.R.S., in the Chair.]

THE following paper has developed from notes made for lectures on vital statistics during the past five or six years, on points which seemed to me to call for further investigation and discussion. The three sections are, practically speaking, three distinct and separate notes: the first on Standardization, the second on the Standard Errors of Comparative Mortality Figures, the third on the age-groups which afford the best indication of occupational mortality, and the interpretation of mortality-ratios at ages.

Section I. *Standardization.*

The first question is, What do we want to do by standardization? My own view may best be expressed by an illustration. If we compare the death-rates at ages in England and Wales for 1931 with those for 1901, for each sex separately, as shown in Table I, we see from the ratios given in columns 4 and 7 of the table that the rates have fallen at all ages up to 75 for males and 85 for females. At the same time the amount of the fall is very different at different ages, apart even from the actual rise in old age. The problem is simply to obtain some satisfactory form of average of all the ratios shown in columns 4 and 7, an average which will measure in summary form the general fall in mortality * between the two epochs, just as an

* It is very long to have to write always of the "relative level of the death-rates in age and sex-groups" and so forth. I propose to use the term *mortality* for short, as I think some other writers have done: *i.e.* if we say that *mortality* is lower in Population A than in Population B, we mean that the death-rates in age and sex groups are on the whole lower, whatever the crude death-rates may be.

index-number measures the general fall or rise in prices. As in the case of other index-numbers we may, if we like, multiply the average obtained by 100 or 1000 and so eliminate that "damned dot."

TABLE I: Showing the death-rates per 1000 living at ages, for each sex, in England and Wales in 1901 and 1931, together with the ratios of corresponding rates in 1931 to those in 1901.

1. Ages.	2. Males. Deaths per 1,000 Living.		3. 1931.	4. Ratio, 1931 to 1901.	5. Females. Deaths per 1,000 Living.		6. 1931.	7. Ratio, 1931 to 1901.
	1901.	1931.			1901.	1931.		
0-	59.0	22.4		0.380	49.5	17.5		0.354
5-	4.0	2.3		0.575	4.1	2.0		0.488
10-	2.3	1.5		0.652	2.4	1.5		0.625
15-	3.5	2.6		0.743	3.2	2.4		0.750
20-	4.7	3.2		0.681	3.8	2.9		0.763
25-	6.2	3.5		0.565	5.3	3.3		0.623
35-	10.6	5.8		0.547	8.7	4.5		0.517
45-	18.0	11.6		0.644	13.8	8.2		0.594
55-	33.5	23.5		0.701	26.5	17.3		0.653
65-	67.8	60.5		0.892	56.5	46.6		0.825
75-	139.8	141.4		1.011	122.6	119.5		0.975
85 up	276.5	291.2		1.053	247.1	282.6		1.144
All ages :								
Crude	18.1	13.0			15.8	11.6		
Standardized ..	18.5	11.4	0.616		15.5	9.2	0.594	
Persons :								
Crude	1901	16.9			1931	12.3	0.728	
Standardized ..	„	16.9			„	10.2	0.604	

Let us note at once a certain distinction: we may deal with either (a) an *average of the ratios* or (b) a *ratio of averages* of the respective death-rates: the second can usually be expressed also in the first form. But a comparison that appears quite legitimate in the form (b) may appear illegitimate in the form (a), and it is as well to state the paradox. The comparison of two or more weighted means seems legitimate so long as the weights are the same: e.g. it seems obviously legitimate to compare $S(wx)/S(wy)$ with $S(wy)/S(wz)$, where w denotes the weights and x, y, z the quantities weighted.

But the first of these ratios may be written

$$\frac{S\left(wy\frac{x}{y}\right)}{S(wy)}$$

and the second

$$\frac{S\left(wz\frac{y}{z}\right)}{S(wz)}.$$

The first weights the ratios by uy and the second by wz and the comparison no longer seems legitimate. My own view is that either form of comparison is legitimate if we have (a) constant weights for the ratios or (b) constant weights for the quantities, *but we must fully recognize what we are doing.*

In the case of the general death-rate for England and Wales, we have to consider both sexes and a number of age-groups. The case is simpler with Occupational Mortality, where we only have to deal with the male sex and with a few age-groups—four in the reports for 1900–2 and 1910–12, and five in the report for 1921–3. Table II gives an illustration from the last report. The table shows

TABLE II: Showing the mean annual death-rates per 100,000 in 1921–3 (England and Wales) of (1) All occupied and retired civilian males, col. 2: (2) Group 7, Coal-mine hewers and getters, col. 3: (3) Group 138, Solicitors, col. 4; and the ratios of corresponding rates to each other.

1. Ages.	2. All (S P.).	3. 7 Hewers	4. 138 Solicitors	5. 3/2.	6. Ratios, 4/2.	7. 4/3.
20-	352	297	242	0·844	0·687	0·815
25-	399	364	196	0·912	0·491	0·538
35-	639	503	568	0·881	0·889	1·009
45-	1,156	973	1,183	0·842	1·023	1·216
55-65	2,572	2,702	2,478	1·051	0·963	0·917

the death-rates at ages for the population taken as base or standard—all occupied and retired civilian males in the Census of 1921—for coal-hewers and for solicitors: in the last three columns are given the ratios of the rates for hewers and solicitors to those for the standard group, and the ratios of the rates for solicitors to those for hewers. We have here just the same problem, though owing to the restricted range of age the ratios do not vary quite so widely, at least in cols. 5 and 6. Any reasonable form of average of the ratios in col. 5 is obviously likely to give a value less than unity, and the same is true for the ratios of col. 6: but in col. 7 the ratios range from 0·5 to 1·2 and different forms of average may give, possibly, values either greater or less than unity.

It is a curious fact that in all the reports on occupational mortality from that for the years 1880–82 onwards, the problem of standardization has always been regarded, as I regard it here, simply as the problem of obtaining an average ratio of mortalities, the results being stated in the form of index-numbers for the different occupations familiar to us as “Comparative Mortality Figures”—a

term due apparently to Dr. Ogle. But in Annual Reports and Statistical Reviews the process is always carried a stage further, viz. to the calculation of a "standardized death-rate." This extension is really superfluous, though it may have its conveniences. It can at once be carried out if we can determine a satisfactory average of the ratios of the death-rates in age and sex-groups in the population considered, say u , on those of the population, say s , taken as base or standard. Let ${}_sR_u$ be this average: let M_s be the crude death-rate in s and ${}_sM_u$ the required death-rate in u standardized to the base s . Then

$${}_sM_u = {}_sR_u \times M_s. \quad . \quad . \quad . \quad . \quad (1)$$

The real problem then is the best way of determining R . R should, of course, possess all the properties that any form of average should possess: it should be rigidly defined, it should be based on all the observations, it should possess some simple and obvious properties to render its general nature easily comprehensible, it should lend itself readily to algebraical treatment, and it should be as little affected as may be possible by fluctuations of sampling. But in addition we may, I think, lay down two further desiderata. In the first place, we do not as a rule desire only to compare *one* group or population u with the standard or base s , but several populations u, v, w , etc. We then evidently have the desideratum:

(a) Average ratios ${}_sR_u, {}_sR_v, {}_sR_w$, etc. should all be properly comparable with each other, *i.e.* the ratios ${}_sR_v/{}_sR_u$, etc. should be averages of the ratios of the sub-death-rates (death-rates in age- and sex-groups) in v to those in u , and so on for all other ratios to ${}_sR_u$, these ratios being comparable with each other.

Any so-called method of standardization which does not fulfil this condition hardly deserves the name at all: it is only a "single-pair" method, and if it is applied to a number of groups it may only be thanks to the mercy of Providence that it is not grossly misleading.

In the second place, if the ratios of ${}_sR_v, {}_sR_w$, etc. to any one of them, say ${}_sR_u$, while properly comparable with each other and thus fulfilling condition (a), differ in some way from the original ratios ${}_sR_u, {}_sR_v$, etc. and are in fact dependent on the nature of the population chosen as base, an element of arbitrariness is introduced which is certainly inconvenient. It would be much more convenient if, whatever population were chosen as nominal base, *i.e.* as the population for which we would call the level of mortality 1000 or 100, the ratios of all R 's *inter se* were in fact independent of that base and of its age or sex composition; just as the ratios *inter se* of index-numbers of prices determined by the method of the geo-

metric mean are in fact independent of the year nominally used as base. We have therefore a second desideratum :

(b) All ratios *inter se* of R_u , R_v , R_w , etc. should be independent of s : we should have for full convenience

$${}_uR_v = \frac{{}_sR_v}{{}_sR_u}$$

for all values of u and v .

No method of standardization hitherto suggested, so far as I am aware, does fulfil this desideratum. Dr. Brownlee,* it is true, suggested the use of Life-Table death-rates " as a measure of hygienic conditions," which they certainly are, though the scale of measurement seems odd : and they are quite independent of any arbitrary base. But they are not a means of standardization. If mortality in Population A is consistently higher than in Population B, the Life-Table death-rate for Population A will be higher than that for Population B, but by no means so much higher as the ratio of mortalities would lead one, perhaps, to expect, because the Life-Table with lower death-rates gives a population with a larger proportion of the aged. To quote an illustration given by me in the discussion cited : if in Population A the death-rates at every age are double those at the corresponding age in B, the ratio of the Life-Table death-rates at birth is only 1.511.

Let us now proceed to consider the methods of standardization which have hitherto been used. These are in essence only two, and as the second does not fulfil desideratum (a) it is, as I have already said of methods failing to fulfil that condition, hardly a method of standardization at all. I shall use the following notation, and the prefix sub- to denote " in age-group " or " in age and sex group " as the case may be—i.e. " sub-death-rate r " means the death-rate in age and sex group r .

Sub-deaths r in population u	...	...	...	...	d_{ur}
Sub-population r „ u	...	...	...	...	p_{ur}
Sub-death-rate d_{ur}/p_{ur}	...	...	...	...	m_{ur}
Crude death-rate in whole population u	...	...	...	...	M_u
Average of ratios d_{ur}/d_{sr} already defined	...	...	...	...	${}_sR_u$
Standardized death-rate in u , standardized to the base s$	...	...	...	...	{}_sM_u$

All death-rates are assumed to be expressed as decimals.

A. *Fixed Base Method. (Direct Method.)* We take R_u as given by the ratio of the expected deaths in the standard population † on

* The use of death-rates as a measure of hygienic conditions. Medical Research Council. Special Report Series, No. 60. 1922. See also Discussion on the Value of Life-Tables, *Jour. Stat. Soc.*, vol. lxxv, 1922, pp. 537 *et seq.*

† I have frequently used the abbreviation S.P. for " standard population " in the sequel. The abbreviation C.M.F. for Comparative Mortality Figure is familiar from the Reports,

the basis of the death-rates in u to the actual deaths in the S.P. That is to say, S_r denoting summation for all values of r ,

$$\left. \begin{aligned} {}_sR_u &= \frac{S_r(m_{ur}p_{sr})}{S_r(m_{sr}p_{sr})} \\ &= \frac{S_r\left(\frac{m_{ur}}{m_{sr}} m_{sr}p_{sr}\right)}{S_r(m_{sr}p_{sr})} = \frac{S_r\left(\frac{m_{ur}}{m_{sr}} d_{sr}\right)}{S_r(d_{sr})} \end{aligned} \right\} \dots \dots (2)$$

Hence the value obtained for R may be regarded *either* as a ratio of weighted means of the sub-death-rates using the standard sub-populations as weights: *or* as a weighted mean of the ratios of the sub-death-rates, using as weights the deaths in the standard population. These weights are therefore the same for all populations u, v, w , etc. and the values of R obtained are properly comparable. More fully, condition (a) is fulfilled, for if we divide through ${}_sR_v$, ${}_sR_u$, etc. by ${}_sR_u$ we have equations of the form:

$$\frac{{}_sR_v}{{}_sR_u} = \frac{S_r(m_{vr}p_{sr})}{S_r(m_{ur}p_{sr})} = \frac{S_r\left(\frac{m_{vr}}{m_{ur}} m_{ur}p_{sr}\right)}{S_r(m_{ur}p_{sr})} \dots \dots (3)$$

The figures now obtained, therefore, may be regarded *either* as ratios of the weighted means of the sub-death-rates using as weights the standard sub-populations: *or* as weighted averages of the ratios of the sub-death-rates, using as weights the deaths expected in s on the basis of the sub-death-rates in u . The weighting of the ratios is changed from that used in equation (2) but remains constant throughout the series of ratios on ${}_sR_u$. It will obviously be changed, however, if we take ratios on ${}_sR_v$ or ${}_sR_u$.

For desideratum (b) is evidently not fulfilled:

$${}_uR_v = \frac{S_r(m_{vr}p_{ur})}{S_r(m_{ur}p_{ur})} \dots \dots \dots (4)$$

and this is not identical with the first part of equation (3), for the sub-populations of u are used and not the sub-populations of s .

If we want to state death-rates standardized on this method, we have by (1)—

$$\left. \begin{aligned} {}_sM_u &= \frac{S_r(m_{ur}p_{sr})}{S_r(m_{sr}p_{sr})} \times \frac{S_r(d_{sr})}{S_r(p_{sr})} \\ &= \frac{S_r(m_{ur}p_{sr})}{S_r(p_{sr})} \end{aligned} \right\} \dots \dots \dots (5)$$

—the familiar process of applying the sub-death-rates of the given population to the standard population.

The direct process of standardization—or *fixed base method* as I would prefer to term it, for it is really no more direct than the next,

and directness is not its distinguishing characteristic—is in many ways an admirable method, and has yielded great service for many years in the publications of the Registrar-General. Its one disadvantage of a general kind is the arbitrariness involved in the failure of condition (b), and the consequent necessity for the choice of a special standardizing population. A more special disadvantage is that the sub-death-rates in the populations u , v , w , etc. must be known, and consequently their deaths must be classified by age and sex—a costly job if there are many populations to be handled. If it is a question of comparing recent data with old, the old data may never have been analysed by age and may not now be available, so that analysis is impossible. For another, if the given populations are many of them small—as in the case of occupations—their sub-death-rates may be untrustworthy, especially at ages in youth and young adult life when mortality is low, and the value of R may in consequence be subject to a high standard error, as Dr. Stevenson pointed out in the Report on Occupational Mortality for 1921–3. The question of standard error is dealt with in the next section of the paper.

In the Annual Reports, now the Statistical Reviews, of the Registrar-General, as we all know, the Census Population of England and Wales in 1901 is taken as the standard population, and if we worked with “index-numbers” it would be natural to regard 1901 as the base for death-rates also. On that basis the comparative Mortality Figure for persons in 1931 (see Table I) would be, multiplying the value of R by 1000, 604. The death-rates for Males and for Females are standardized on the population of persons in 1901, so as to give rates comparable with each other, though only more or less doubtfully comparable with the rate for persons. The comparability of the rates for the two sexes is justified by the fact that all the rates are weighted means of the sub-death-rates with the same weights. It must be remembered, however, that if we compare, say, the ratio of the standardized death-rate for Males in 1931 to the standardized death-rate for Males in 1901 with the same ratio for Females, and compare these two averages with the sub-ratios m_{ur}/m_{sr} and m_{1r}/m_{sr} at ages, the two averages, considered as averages of ratios, are based on *different* weights, cf. equation (3). For Males the weights of the ratios at ages are the expected deaths in the S.P. on the basis of sub-death-rates for Males 1901: for Females the weights are the expected deaths in the S.P. on the basis of sub-death-rates for females 1901. It is a practical example of the paradox noted at the beginning of this section.

In the Occupational Mortality Reports for 1900–2 and for 1910–12 the standard population used was that for All Males aged 25–65 in

1901: in the Report for 1921-3 this was changed to All Occupied and Retired Civilian Males aged 20-65 in 1921. The actual numbers in the age-groups 20-, 25-, 35-, 45-, 55-65 were reduced to the totals that would give 1000 deaths at the sub-death-rates shown in col. 2 of Table II, and consequently "Comparative Mortality Figures" could readily be calculated at once by simply applying to this population the death-rates for the given occupation. The Comparative Mortality Figures for the two occupations shown in Table II are 938 and 899, which would suggest an average for the last column of $899/938$ or 958. The weighting of ratios used here (see above) is not, however, the same as for the Comparative Mortality Figures. There is no reason why we should not use the same weights, viz. weights proportional to the deaths in the S.P., which are as follows, reduced to a total of 10,000:

20-	...	...	...	...	...	531
25-	...	...	...	...	...	1,130
35-	...	...	...	...	...	1,746
45-	...	...	...	...	...	2,718
55-	...	...	...	...	...	3,875
						10,000

These give a value for R from col. 7 of 966. Any reader who likes can check the values 938 and 899 with those weights from cols. 5 and 6, though in the latter he will get 898.4, which would round off to 898 only, owing to the limited number of digits retained.

Before concluding this section, it may be pointed out, for comparison with an equation in the next section, that (5) may be thrown into a form involving M_u , the crude death-rate in u , on the right, though this only involves multiplying and dividing by M_u . We have, in fact

$${}_sM_u = \frac{S_r(m_{ur}p_{ur})}{S_r(p_{sr})} \times \frac{S_r(p_{ur})}{S_r(m_{ur}p_{ur})} \times M_u \quad . \quad . \quad . \quad (6)$$

B. Changing Base Method. (*Method of expected deaths, and Factor Method.*) We now take ${}_sR_u$ as given by the ratio of the actual deaths in u to the expected deaths in u on the basis of the sub-death-rates in s . That is to say—

$${}_sR_u = \left. \begin{aligned} &\frac{S_r(m_{ur}p_{ur})}{S_r(m_{sr}p_{ur})} \\ &\frac{S_r\left(\frac{m_{ur}}{m_{sr}}m_{sr}p_{ur}\right)}{S_r(m_{sr}p_{ur})} \end{aligned} \right\} \cdot \cdot \cdot \cdot \cdot \quad (7)$$

${}_sR_u$ may again be regarded *either* as a ratio of weighted means of the

m 's using the u -populations, however, as weights, or as a weighted mean of the ratios of the sub-death-rates; but the weights of ratios are now the expected deaths in u on the basis of the sub-death-rates in s . These weights are evidently different for u , v , w , etc. and consequently desideratum (a) is not fulfilled. We have, in fact—

$$\left. \begin{aligned} \frac{{}_sR_v}{{}_sR_u} &= \frac{S_r(m_{vr}p_{vr})}{S_r(m_{sr}p_{vr})} \times \frac{S_r(m_{sr}p_{ur})}{S_r(m_{ur}p_{ur})} \\ &= \frac{S_r(m_{vr}m_{ur}p_{vr})}{S_r(m_{ur}p_{vr})} \times \frac{S_r(m_{ur}p_{ur})}{S_r(m_{ur}p_{ur})} \times \frac{S_r(m_{sr}p_{ur})}{S_r(m_{sr}p_{vr})} \end{aligned} \right\} \quad (8)$$

and this cannot be expressed as a weighted mean of the ratios m_{vr}/m_{ur} with constant weights. In fact, as the second form of the equation shows, it is a weighted mean with variable weights (varying with v) multiplied by a complex correcting term. I do not see that it can be expressed as any form of average of the ratios m_{vr}/m_{ur} . As (a) is not fulfilled, (b) is clearly not fulfilled either. The method is not fully a method of standardization at all, but is only safe for the comparison of single pairs of populations.

If we want to see actual death-rates standardized on this method, we have by (1)—

$${}_sM_u = \frac{S_r(m_{ur}p_{ur})}{S_r(m_{sr}p_{ur})} \times \frac{S_r(m_{sr}p_{sr})}{S_r(p_{sr})} \quad (9)$$

This does not simplify in the same way as (5), and we would like to get it with the form involving M_u , the crude death-rate in u . We then have

$$\begin{aligned} {}_sM_u &= \frac{S_r(m_{sr}p_{sr})}{S_r(p_{sr})} \times \frac{S_r(p_{ur})}{S_r(m_{sr}p_{ur})} \times M_u \\ &= {}_sF_u \times M_u \end{aligned} \quad (10)$$

say. In the factor F , the first fraction is the actual death-rate in the standard population; $S_r(m_{sr}p_{ur})/S_r(p_{ur})$ is the expected death-rate in u on the basis of the sub-rates in s and has been called by Dr. Stevenson the "index death-rate" for u . It is from this factor-form that the method was called the "factor method." Comparing the form of the factor in (10) with that which it would take on the fixed-base method in (6), we see that while in (10) it is the actual death-rate in the S.P. and the index death-rate for u (on the basis of sub-rates in s) that are involved, in (6) it is the index death-rate for S.P. (on the basis of the sub-rates in u) and the actual death-rate in u . The present names for the method are not very suitable: both A and B are methods of "expected deaths," and the use of a factor is only incidental.

This method was used for standardizing all district rates in the Annual Report for 1911 and a few reports following. But a

variation was made from the simple procedure above. In the above we are using *s* wholly as the standard population, as seems natural—using both its sub-death-rates and its sub-populations. Dr. Stevenson used (1) the Census population of England and Wales in 1901 as the standard population, as for Method I, but (2) the average death-rates for England and Wales 1901–10 as the standard death-rates. The result is that the first fraction in *F* takes the form of an index death-rate for *s* instead of the actual death-rate. The method seems equivalent to changing the base from *s* (England and Wales 1901–10 for both death-rates and populations in this case) to, say, *u* (England and Wales, 1901) by merely dividing through ${}_sF_v$, ${}_sF_w$, etc. by ${}_sF_u$. This would give the (really illegitimate) standardizing relation—

$${}_uM_v = \frac{S_r(m_{sr}p_{ur})}{S_r(p_{ur})} \times \frac{S_r(p_{rr})}{S_r(m_{sr}p_{rr})} \times M_v \quad . \quad . \quad (11)$$

The first fraction is now the index death-rate for England and Wales, 1901, using the sub-rates for 1901–10.

While describing Method B, as I think it must be described, as really illegitimate if used for more than single-pair comparisons, I fully recognize that it has rendered valuable results and can be exceedingly useful. It does not require sub-death-rates for the populations whose death-rates are to be standardized, and it consequently is applicable to data where such an analysis is not available. Where, as in the case of all the administrative areas for which rates are given in the Annual Reports for 1911–13, analysis could be carried out but its cost would be prohibitive, approximate standardized rates could be calculated at relatively small expense. But the non-comparability, strictly speaking, of these rates *inter se* should always be borne in mind. At what would be a relatively modest cost better factors could be calculated on the basis of (6). If in the Census year directly standardized death-rates were calculated for all the administrative areas, the ratios of these to their crude death-rates would then give factors for subsequent use, till the next Census gave further data. As the deaths for the whole country are in any case analysed by age, this would only mean their further analysis by district. For Method B it must also be said that it may be advantageous in avoiding the use of the sub-death-rates m_{ur} if these are based on small populations and small numbers of deaths: I return to this question in subsequent sections of the paper.

The values of the average ratios m_u/m_s determined by this method for the two occupational groups, Hewers and Solicitors, of Table II are 0.918 and 0.945 respectively, suggesting an average ratio of the mortality of the second group to that of the first of

1.029, whereas Method A gave 0.958, and an application of the weights used when the S.P. is taken as base gave 0.966. Differences of method may, as was suggested, show the mortality of the second group as either slightly greater or slightly less than that of the first. It often seems odd that the two C.M.F.'s ($1000 \times {}_sR_u$)

TABLE III: Showing (data of 1921-3) for the Standard Population, 7 Hewers and 138 Solicitors, the distribution over ages of the populations and the death-rates: for the S.P. the distribution of deaths: for Hewers and Solicitors the ratios of death-rates to those in the S.P. taken as 1000 (cf. Table II) and the distributions of expected deaths.

Age.	Standard Population.		7 Hewers.		138 Solicitors.	
	Popula- tion.	Death- rates.	Popula- tion.	Death- Rates.	Popula- tion.	Death- rates.
20-	1,381	352	1,589	297	99	242
25-	2,591	399	3,249	364	1,581	196
35-	2,499	639	2,577	563	2,645	568
45-	2,151	1,156	1,809	973	2,839	1,183
55-65	1,378	2,572	776	2,702	2,836	2,478
Total	10,000	—	10,000	—	10,000	—

Age.	Standard Population Deaths.	7 Hewers.		138 Solicitors.	
		Ratios.	Expected Deaths.	Ratios.	Expected Deaths.
20-	531	844	736	687	27
25-	1,130	912	1,709	491	488
35-	1,746	881	2,169	889	1,307
45-	2,718	842	2,755	1,023	2,538
55-65	3,875	1,051	2,631	963	5,640
Total	10,000	—	10,000	—	10,000

Constants calculated. Coefficients of variation: S.P. deaths 0.6280: Hewers, expected deaths, 0.3661: Solicitors, expected deaths, 1.0047.

Standard Deviations of ratios x : Hewers, 76.98: Solicitors, 195.91.

Correlations (x = ratios, w = deaths in S.P., w' = expected deaths in occupation): Hewers: xw , +0.6581: xw' , +0.4099. Solicitors: xw , +0.7141: xw' , +0.6816.

determined by the fixed base (direct) and changing-base (expected deaths) methods (say C_1 and C_2) do not in fact differ more than they do: the actual difference may frequently be of little practical importance. The difference between two weighted means M_w and M'_w of the same set of variables x will, by a well-known theorem, be given by

$$M'_w - M_w = \sigma_x (r' c'_w - r c_w) \quad . \quad . \quad . \quad (12)$$

where σ_x is the standard deviation of the variables, r' and r are the respective correlations between weights and variables, and c'_w , c_w the respective coefficients of variation (expressed as decimals) of the weights. If σ_x is zero, *i.e.* if in our case all the ratios of sub-rates are the same, no variation of weighting can make any difference: unless to begin with the ratios vary largely, $M'_w - M_w$ cannot be large. Dr. Stevenson, judging by occasional comments in the Reports, seems to have been able readily to judge by mere inspection of the tables the reasons for a given difference between C_2 and C_1 . Personally I find this next to impossible, and—unless one is dealing with a series of groups that tend to behave similarly, like the Coal-hewers in different districts—am usually quite at a loss even to conjecture what the sign of the difference will be. In Table III I give full details for the groups of Hewers and Solicitors as against the Standard Population (1921-3). All the reader would find in the original tables are the populations (but not reduced for comparison to totals of 10,000)—the death-rates—and the ratios m_{wr}/m_{sr} (identical with the ratios of actual to expected deaths), which I have here multiplied by 1000 so that equation (12) shall have the right value of σ_x . So any reader can see for himself how far *he* could conjecture the sign, or sign and approximate magnitude of $C_2 - C_1$ the values being

Hewers C_1	938	Solicitors C_1	899
C_2	918	C_2	945
— 20		+ 46	

From the values of the constants given below Table III we have :

Hewers :

$$r'c'_w = 0.4099 \times 0.3661 = 0.1501$$

$$rc_w = 0.6581 \times 0.6281 = 0.4133$$

$$- 0.2632$$

$$\sigma_r = 76.98$$

$$\sigma_x(r'c'_w - rc_w) = - 76.98 \times 0.2632$$

$$= - 20.26$$

Solicitors

$$r'c'_w = 0.6816 \times 1.0047 = 0.6848$$

$$rc_w = 0.7141 \times 0.6280 = 0.4485$$

$$r'c'_w - rc_w = + 0.2363$$

$$\sigma_x = 195.91$$

$$\sigma_x(r'c'_w - rc_w) = + 195.91 \times 0.2363$$

$$= + 46.29$$

In the first case the value of σ_x is comparatively modest: the difference is increased because both r' is less than r and c'_w is less than c_w . In the second case, σ_x is much larger: the two r 's do not differ much, but c'_w is a good deal larger than c_w . The differences are quite differently conditioned. To obtain a high value of $C_2 - C_1$ it would be necessary that simultaneously σ_x should be large, r' should largely exceed (or fall below) r , and c'_w should largely exceed (or fall below) c_w : it is relatively unlikely that all three conditions will be fulfilled together. And perhaps it may be remarked that if σ_x is large, *i.e.* if the ratios m_{ur}/m_{sr} are very different in different age groups, any comparative mortality figure becomes of questionable value.

To illustrate more fully the extent to which the (illegitimate) ratios of the C_2 's *inter se* may differ from those of the C_1 's I have drawn up Table IV. This gives, for seven professions and the group of Coal-hewers, all possible ratios *inter se* of the C_1 's and C_2 's, the ratio being taken in each case on the corresponding coefficient at the head of the column.* All figures for C_1 in any one column (not row of course) are properly comparable: the figures for C_2 are not. The differences for Barristers are throughout exceptionally large, but readers of the Report will remember that in this case the difference turns mainly on a single death in the age-group 20—where only 0.36 deaths are “expected.” Even apart from this group however, differences are sometimes considerable: according to C_1 the Medical Profession has a mortality 60 per cent., according to C_2 44 per cent. above that of “Ministers, other” (see col. headed 136); according to C_1 the same profession has a mortality 13.6 per cent., according to C_2 7.5 per cent. above that of Solicitors (col. headed 138), for example, and—to whatever qualifications the first figure may be subject—the second is based on an improper comparison.

Before passing to the next method which I have to discuss, I have to say something on a minor source of errors which affects the results of both Methods A and B, and may affect them very sensibly if ten-year age-groups are used. In these methods we take the two death-rates m_{ur} and m_{sr} as comparable. But in fact they are not—save exceptionally—strictly comparable, for the age-distributions within the two groups will in general differ from each other; we ought to standardize by single years of age. To find out the possible order of magnitude of such errors I made a couple of experiments. For the first I used the mortality experience for

* C_2 's are only given in the Report to two figures, *i.e.* on a basis of 100, not 1000: I have calculated them to a base of 1000, using for this purpose S.P. death-rates calculated to a digit beyond that given in the Report.

TABLE IV : Showing the ratios *inter se*, for certain occupations, of (1) C_1 , the C.M.F. by the fixed base (direct) method, (2) C_2 , the C.M.F. by the changing-base method (method of expected deaths). The figures in the compartments of the table show the ratios ($\times 1000$) of the C.M.F. on the left of the row to the corresponding C.M.F. at the top of the column.

		134.	135.	136.	137.	138.	139.	140.	7.
134. Clergy, Anglican.	C_1 561	C_1 561	C_1 780	C_1 639	C_1 1,171	C_1 899	C_1 1,021	C_1 910	C_1 938
	C_2 605	C_2 605	C_2 815	C_2 704	C_2 1,063	C_2 945	C_2 1,016	C_2 919	C_2 918
135. R.C. Priests, monks	C_1 561	1,000	719	878	479	624	549	616	598
	C_2 605	1,000	742	859	569	640	595	658	659
136. Ministers, other.	C_1 780	1,390	1,000	1,221	666	868	764	837	832
	C_2 815	1,347	1,000	1,158	767	862	802	887	888
137. Barristers.	C_1 639	1,139	819	1,000	546	711	626	702	681
	C_2 704	1,164	864	1,000	662	745	693	766	767
138. Solicitors.	C_1 1,171	2,087	1,501	1,833	1,000	1,303	1,147	1,287	1,248
	C_2 1,063	1,757	1,304	1,510	1,000	1,125	1,046	1,157	1,158
139. Registered Medical Practitioners.	C_1 899	1,602	1,153	1,407	768	1,000	881	988	958
	C_2 945	1,562	1,160	1,342	889	1,000	930	1,028	1,029
140. Dentists.	C_1 1,021	1,820	1,309	1,598	872	1,136	1,000	1,122	1,088
	C_2 1,016	1,679	1,247	1,443	956	1,075	1,000	1,103	1,107
7. Coal-mine : hevers and getters.	C_1 910	1,622	1,167	1,424	777	1,012	891	1,000	970
	C_2 919	1,519	1,128	1,305	865	972	905	1,000	1,001
	C_1 938	1,672	1,203	1,468	801	1,043	919	1,031	1,000
	C_2 918	1,517	1,126	1,304	864	971	904	999	1,000

Males and Females in 1920-22 as given in the Registrar-General's Decennial Supplement, 1921, Part I, Life-Tables. Taking the 10-year age-group 55-65, and the death-rate for Females in this age-group as 1000, the death-rate for Males would be represented by 1338. But if we work by single years of life and standardize the Male rate on the Female population the ratio is 1346. So the error is 8 points, or say 5.9 points per 1000. For a second experiment I used the data for the same age-group (55-65) for the Standard Population and for Group 164, General Labourers (Decennial Supplement, 1921, Part II). By a simple second-difference method I distributed the lives at risk in the S.P., and both lives and deaths in Group 164 over single years of life: the process was rough, but gave reasonable results and was probably adequate to my purpose. Calling the death-rate for the S.P. 1000 as usual, that for General Labourers is represented by 1349. Standardizing by single years of life on the S.P. I make the figure only 1339. There is therefore an error of 10 points, or say 7.5 points per 1000. For some of the smaller and more divergent groups* the error might well be greater, and I see no reason why it should not be of the same sign throughout the ages 25 to 65 and affect the ultimate C.M.F. with an error of the same order of magnitude. The magnitude of the error may be of no practical importance, but I want the reader to bear the point in mind when we consider the next method.

Both Method A and Method B are old and well-known methods. But clearly *any* method of averaging the fundamental ratios m_{ur}/m_{sr} is legitimate so long as it fulfils the required conditions. I now proceed to discuss a possible method which seems to me to possess notable advantages, though it has its own special limitation.

C. *The method of equivalent average death-rates.* Consider the section of a life-table between ages x and $x+h$. The central death-rate m_x continually changes as we pass from x to $x+h$ —rises without a break if we are dealing with years in adult life—and these varied death-rates combine to give a certain chance of survival from age x to age $x+h$ say ${}_h p_x$. Suppose we replaced these varying death-rates by a death-rate which was constant over the interval: there must be some value for the constant death-rate which would yield the same value for ${}_h p_x$, the chance of survival. This is the quantity that I term the "equivalent average death-rate." For any given population u it is obviously distinct from the crude death-rate between ages x and $x+h$, for the crude death-rate is dependent on the age-distribution. Let us denote it by

* I judged it impossible satisfactorily to distribute lives at risk and deaths over single years in these smaller groups.

$M(u, x, x+h)$, using a functional notation to avoid many and lengthy subscripts. Now

$$p_x = e^{-m_x} \quad . \quad . \quad . \quad . \quad . \quad (13)$$

to a very high degree of approximation: the equation is strictly true if for m_x is substituted the integral of the force of mortality over the year. Hence for the interval x to $x+h$ —

$${}_h p_x = e^{-(m_x + m_{x+1} + \dots + m_{x+h})} \quad . \quad . \quad . \quad (14)$$

That is to say—

$$M(u, x, x+h) = \frac{1}{h} S_x^{x+h}(m_x) \quad . \quad . \quad . \quad (15)$$

to a high degree of approximation: strictly the value is the mean of the integral of μ_x . Hence if death-rates were available year by year there would be no difficulty in obtaining quite a close value for the equivalent average death-rate: it would be simply the arithmetic mean of the death-rates at ages. The obvious limitation to the conception is that we cannot deal with the whole of life or M will merely become indefinitely great. In the special case of Occupational Mortality, however, we are only concerned with a limited interval of age and the difficulty does not arise. Using an obvious extension of our notation for R , we may then take for a single year grouping

$${}_s R_u(x, x+h) = \frac{S_x^{x+h}(m_{ux})}{S_x^{x+h}(m_{sx})} \quad . \quad . \quad . \quad (16)$$

which would also clearly amount to making R a weighted average of the ratios m_{ux}/m_{sx} using as weights m_{sx} . These weights will therefore tend to weight the ratios of sub-death-rates at advanced ages more heavily than the weights used in Methods A or B, for m_{sx} increases rapidly and continuously as age advances while the actual deaths tail away towards the end of life. This is certainly a drawback to the present method—supposing we can carry it out: but, on the other hand, it clearly possesses very great advantages, for it fulfils not only desideratum (a) but also desideratum (b). We have completely freed ourselves from the necessity for using any arbitrary standard population, the ratios of $M(u, x, x+h)$, $M(v, x, x+h)$, $M(w, x, x+h)$, etc. *inter se* being all completely comparable, as ratios of averages of the death-rates with fixed weights. The population chosen as base (C.M.F. = 1000) would be no more than a nominal base.

In a paper published nine years ago * I showed that the relation

$${}_h p_x = e^{-h m_x} \quad . \quad . \quad . \quad . \quad . \quad (17)$$

* Some life-table approximations. International Mathematical Congress, Toronto, Canada, 1924.

where ${}_h m_x$ is the death-rate for the age-group x to $x + h$, held good to a surprisingly close degree of approximation for five-year age-groups, when tested on the Life-Tables No. 8 between ages 10 and 40. For $h = 10$, however, there was an error increasing with age, and a fairly satisfactory fit—better than that given by Dr. Snow's formulæ*—over ages 25–85 was only obtained by the use as a second approximation of the formula,

$${}_h p_x = e^{-h{}_h m_x(1 + a{}_h m_x)} \quad . \quad . \quad . \quad . \quad (18)$$

the value found for a on the basis of Life-Tables No. 8 being 0.864.

Trial on Life-Tables No. 9 showed that even for five-year age-groups (17) failed to give a satisfactory approximation after age-group 55–, when ${}_h m_x = 0.02$ and there was a failure of the same type as had before been found for the ten-year age-groups, (17) giving values for p that were too high to an extent that increased as age advanced. The form (18) did not yield a very satisfactory approximation either, and I spent some time worrying over the problem then presented. The solution came by trial on another line. It occurred to me that in corresponding age-groups errors by formula (17) would be of comparable magnitude, and consequently, notwithstanding the errors, the values of $\log p$ might still be approximately proportional to the death-rates. I tested the notion on Life-Table 9 for Males against Life-Table 9 for Females, using for death-rates of course the data on which these tables were based. Table V shows the results for five-year age-groups and Table VI for ten-year age-groups. They are, I think, extremely good. With two exceptions—in one of which the divergence was so outstanding as to make me suspect an error, though I could not find one—the errors for the five-year groups are all well under 1 per cent., the mean error being 6 points per thousand. The errors are of irregular sign. For the ten-year age-groups the mean error is but little greater, viz. 6.5 points per thousand, but the errors are all negative. They are, however, only of the same order of magnitude as those which, as we have just shown, affect the C.M.F. calculated in the ordinary way when we work with ten-year age-groups, and may, I think, be regarded as unimportant. It must further be remembered that the death-rates are founded on the raw data, and are for the usual age-groups, not those specially chosen to minimize the effect of preferences for particular final digits of age. The values of $\log p$, on the other hand, are founded not on raw data but on life-tables: that is on data subjected to the highest of high-class cookery to make the figures run very smoothly. We may well conjecture

* Supplement to the Seventy-Fifth Annual Report of the Registrar-General: Part II, abridged Life-Tables, 1920. Cmd. 1910.

that, had the death-rates been determined from graduated deaths and populations, the divergences would probably have been more regular and slightly smaller, and the conjecture is confirmed by an investigation described below.

TABLE V: Ratios of (1) Male to Female death-rates (female = 1000) in quinquennial age groups, 1920-22: (2) Male to Female values of $\log p$ (female = 1000) from Life-Tables No. 9.

1. Age Group.	2. Male on		3.	4. Error per 1,000 of 2 on 3.
	Death-rates.		Female. $\log p$.	
10-	951		948	+ 3.2
15-	1,067		1,060	+ 6.6
20-	1,157		1,147	+ 8.7
25-	1,089		1,110	-18.9
30-	1,167		1,160	+ 6.0
35-	1,256		1,256	—
40-	1,301		1,315	-10.6
45-	1,308		1,298	+ 7.7
50-	1,306		1,310	- 3.1
55-	1,352		1,348	+ 3.0
60-	1,337		1,348	- 8.2
65-	1,324		1,324	—
70-	1,274		1,274	+ 2.4
75-	1,225		1,230	- 4.1
80-85	1,173		1,182	- 7.6
Mean	—		—	- 1.0
Mean without regard to sign	—		—	6.0

TABLE VI: as Table V but for ten-year age-groups.

1. Age Group.	2. Male on		3.	4. Error per 1,000 of 2 on 3.
	Death-rates.		Female. $\log p$.	
25-	1,130		1,136	- 5.3
35-	1,282		1,288	- 6.2
45-	1,306		1,305	+ 0.8
55-	1,338		1,348	- 7.4
65-	1,282		1,293	- 8.5
75-85	1,188		1,201	-10.8
Mean	—		—	- 6.2
Mean without regard to sign	—		—	6.5
" " " " 25-65	—		—	4.9

Tables V and VI are then fairly satisfactory as far as they go: but they still do not carry us the whole way. Table VII applies the necessary further test, to see whether the sums of death-rates in a series of successive age-groups in the two sexes stand in the

same ratio to one another as the values of $\log p$ for the whole age interval considered. It will be seen that for five-year age-groups the mean error is no more than 2.5 parts in 1000: for the ten-year groups, taken from age 25, 5.7 parts in 1000. It is true that the divergences clearly indicated a biased error, but it does not seem to me that even a biased error of this magnitude is of much importance. For some purposes it is useful to consider separately old age and younger ages, so I give the next comparison for ages 55-85

TABLE VII: As Tables V and VI but using the sums of death-rates over long periods of life: (a) death-rates for quinquennial groups, (b) death-rates for decennial groups.

1.	2.	3.	4.	5.
Age Interval.	Years.	Male	Female.	Error per 1,000 of 3 on 1.
		Sum of Death- rates.	log <i>p</i> .	
Using 5-year age groups.				
10-45	35	1,176	1,178	-1.7
10-65	55	1,282	1,285	-2.3
10-75	65	1,289	1,289	—
10-85	75	1,234	1,238	-3.2
25-45	20	1,217	1,224	-5.7
25-65	40	1,303	1,307	-3.1
25-75	50	1,298	1,299	-0.8
25-85	60	1,237	1,241	-3.2
Mean	—	—	—	-2.5
Using 10-year age groups.				
25-45	20	1,217	1,224	-5.7
25-55	30	1,261	1,264	-2.4
25-65	40	1,300	1,307	-5.4
25-75	50	1,290	1,299	-6.9
25-85	60	1,231	1,241	-8.1
Mean	—	—	—	-5.7
Using 10-year groups: old age.				
55-85	30	1,228	1,239	-8.9
65-85	20	1,215	1,226	-9.0
Using grouping as for Occupational Mortality.				
20-65	45	1,294 *	1,300	-4.6

* The five-year group given a weight of 1, the ten-year groups a weight of 2 in summing death-rates.

and 65-85. Here the divergence reaches nearer to 1 per cent. In the last line of the table the test is applied for the grouping used in the last Report on Occupational Mortality (20-, 25-, 35-,

45-, 55-65). In this case, in place of the simple sum of the death-rates, we must evidently use the sum *death-rate in 5-year age-group 20-25 + twice sum of death-rates in remaining 10-year age-groups*. The error is only 4.6 points per 1000. Broadly speaking I think we may conclude that *for ages over 10 years the equation is true to within a few parts in 1000* :

$${}_sR_u(x, x+h) = \frac{M(u, x, x+h)}{M(s, x, x+h)} \left\{ \begin{array}{l} \\ \\ \\ \end{array} \right. \dots \dots (19)$$

$$= \frac{S_r(h, m_{ur})}{S_r(h, m_{sr})}$$

where the sums are, of course, taken over the age-groups within the limits x and $x+h$. If all the age-groups are for the same number of years, we simply take the ratio of their sums. If some are five-year and other ten-year groups we weight the latter by 2. I would hardly have dared to suggest a process which on the face of it looks so nearly lunatic—so contrary to all the normal canons for dealing with death-rates—without the preliminary discussion. But this, it seems to me, does justify it. The arithmetic is sublimely simple. I take the case of Group 1, Farmers, etc. against the Standard Population (1921-3) :

					Death-rate per 100,000.	
Age Group.					Standard Population.	1. Farmers.
20-	...	...	...	...	352	196
25-	...	...	...	...	399	300
					399	300
35-	...	...	...	...	639	447
					639	447
45-	...	...	...	...	1,156	761
					1,156	761
55-	...	...	...	...	2,572	1,713
					2,572	1,713
Totals ...	...	...	...	...	9,884 *	6,638

* As a matter of fact for the work of Table VIII I used the divisor 9,885, based on death-rates carried to another place of decimals.

$$C.M.F. (C_3) = 6,638 \times 1,000/9,884 = 672.$$

I give in Table VIII the values of C_3 for a series of 50 occupational groups: I happened to work out first the figures for Coal-hewers in the different fields, for the professions and some others, and then added every group the number of which ended with 1 to get a good varied sample. C_1 is given for comparison. For the most part the two numbers agree fairly closely, but here and there the divergence runs up to some 4 or 5 per cent. (e.g. 7c. Coal-hewers, Cheshire and

TABLE VIII: Comparing C₁ (the C.M.F. by Method A, the Direct Method) with C₃ (the C.M.F. by Method C, the method of the equivalent average death-rate) for 50 Occupational Groups (1921-23): titles of groups abbreviated.

Group.		C ₁ .	C ₃ .
1.	Farmers and their relatives	674	672
2.	Gardeners and their labourers	707	698
3.	Farm Bailiffs and Foremen	526	546
4.	Woodmen and Labourers in woods and forests	714	681
5.	Agricultural Labourers (including Shepherds)	688	681
7.	Coal-mine—Hewers and Getters	938	961
7a.	" Northumberland	830	848
7b.	" Durham	824	832
7c.	" Cheshire and Lancashire	1,109	1,155
7d.	" Yorkshire: West Riding	975	981
7e.	" Nottinghamshire	831	851
7f.	" Derbyshire (excluding South Derby)	776	788
7g.	" North Staffordshire	1,015	1,052
7h.	" Staffs. (excluding North Staffs.): Shrops.: Worcester	945	977
7i.	" Leicester, Warwick, South Derby	763	782
7j.	" Glamorgan	1,001	1,042
7k.	" Monmouth	923	938
7l.	" Brecknock, Carmarthen, Pembroke	1,135	1,174
7m.	" Cumberland	960	912
7n.	" Gloucestershire, Somerset	817	857
11.	Coal-mines: above ground, not superintending staff	1,183	1,163
13a.	Tin and Copper Miners—underground workers, not superintending staff	4,335	4,344
14a.	Miners and Quarriers of Igneous Rocks (not Granite)	573	545
14b.	Limestone Miners and Quarriers	918	892
14c.	Sandstone Miners and Quarriers	1,644	1,702
15.	Slate Miners and Quarriers	944	984
21.	Brick, Tile, etc., Kiln and Oven men	878	921
31.	Smiths and skilled Forge-workers	951	969
38.	File-cutters	1,851	1,814
41.	Metal Glazers, etc.	1,443	1,436
51.	Cotton Blow-room hands, skilled	1,516	1,507
61.	Woollen and Worsted Weavers	1,082	1,104
71.	Boot and Shoe Operatives, skilled—not clickers	1,120	1,108
81.	Sawyers	868	860
91.	Bricklayers	854	866
101.	Drafters and Brushmakers	1,320	1,224
111.	Livery Stable, Garage Proprietors	791	796
121.	Messengers, Hall Porters, etc.	1,200	1,148
131.	Auctioneers, Valuers	1,031	1,025
134.	Clergy, Anglican... ..	605	579
135.	Roman Catholic Priests, Monks	780	821
136.	Ministers, other denominations	639	683
137.	Barristers	1,171	1,124
138.	Solicitors	899	920
139.	Registered Medical Practitioners	1,021	1,023
140.	Dentists	910	901
141.	Teachers (not teachers of music)	736	737
151.	Gamekeepers	667	662
161.	Storekeepers	952	933
164.	General Labourers	1,438	1,419

Lancashire, 7j. Glamorgan, 7m. Cumberland, 7n. Gloucestershire; and the groups 135 and 136). Where, as for the Coal-hewers, the trend of m_{ur}/m_{sr} with age is generally similar, the difference C_3-C_2 will tend to be of the same sign. For Hewers mortality tends to be markedly higher, compared with that of the S.P., in the last age-group 55-65: C_3 weights this age-group more heavily than does C_1 , and consequently C_3-C_1 tends to be positive, and is in fact positive for every coal-field except Cumberland where the mortality at 55-65 is exceptionally low.

But for general purposes of standardization we may require to deal with the whole of life—or rather with life from age 0: as already pointed out we can, on this method, only deal with a period terminating at a definite age. I used the same life-table comparison for this test: but for death-rates at ages 0-5 employed the estimated, not the Census populations. The results are shown in Table IX.

TABLE IX: As Table VIII but for periods from the beginning of life: in the second part of the table ten-year groups are given a weight of 2.

1.	2.	3.	4.	5.
Age Interval.	Years.	Male	on Female.	Error per 1,000 of 3 on 4.
		Sum of Death- rates.	log <i>p</i> .	
Five-year age-groups.				
0-10	10	1,225	1,198	+22.5
0-25	25	1,193	1,168	+21.4
Five-year groups to age 25 : thence ten-year groups.				
0-35	35	1,182	1,162	+17.2
0-45	45	1,201	1,188	+10.9
0-55	55	1,227	1,218	+ 7.3
0-65	65	1,265	1,264	+ 0.8
0-75	75	1,273	1,278	- 3.9
0-85	85	1,228	1,235	- 5.7

As might be expected, errors are much more considerable using this rather crude grouping at the beginning of life,* of the order of 2 per cent.—but the death-rate ratio is higher not lower than the log p ratio. The error does not drop to about 1 per cent. till we have extended the range to 0-45. It continues dropping till the range 0-65, for which it practically vanishes, and thereafter becomes increasingly negative—though still only of the order one-half of one per cent. at 0-85. We could take 0-85 quite well for a “whole-

* There must surely be a precisely similar error on the ordinary method of standardization (Method I).

life " comparison so far as error is concerned, but as shown by the illustration below the result is over-weighted by the high death-rates at 65-85. Separate figures for 0-65 and 65-85 are better, thus keeping clear the old age groups in which changes are apt to be relatively smaller or in the reverse direction to those at lower ages.

Before passing to an illustration, however, let me state the results of a test made to see how far the graduation of the life-tables, as suggested above, was responsible for some of the divergences between the m -ratios and the log p -ratios. The test was made by calculating m_x by the equation

$$m_x = 2q_x / (1 + p_x)$$

year by year in each of the life-tables—a proceeding obviously not very accurate when q_x is given to three figures only—and then applying these values of m_x to the populations grouped by single years of age. The deaths so calculated gave values for m_{ur} and m_{sr} really corresponding to the life-table death-rates, and so corresponding values for the m -ratios. The work was not carried out quite so completely as in Tables V, VI, VII and IX, but the principal results are as follows. For the fifteen five-year groups of Table V the mean error without regard to sign is brought down from 6.0 points per thousand to 1.5: the error of -18.9 in the age-group 25- is altered to +2.7, and the error of -10.6 in the age-group 40- is altered to +0.8. For the six ten-year groups of Table VI the mean error is brought down from 6.5 points per thousand to 4.2: the error of -10.8 in the age-group 75- is altered to +3.4, but in the preceding age-group 65- the error of -8.5 is actually increased to -10.9—a puzzling result if I have made no slip. For the five longer age-periods using the ten-year grouping, in the centre of Table VII, the mean error is reduced from -5.7 points per thousand to -3.7. For the two old-age groups in the next section of that table the errors are reduced to -6.5 and -7.3 per thousand respectively. And finally, for the Occupational Mortality grouping in the last section of Table VII the ratio based on the sum of the death-rates is raised from 1294 to 1296, or the error reduced from -4.6 to -3.1 points per 1000. The result of the investigation strengthens one's confidence in the method of standardization now suggested—and somewhat reduces one's confidence in the life-tables.

Tables X, XI, XII give data for my illustration, viz. a comparison of mortality in England and Wales in 1911, 1921 and 1931, with that in 1901, for the two sexes separately. Table X shows the expected deaths at ages in 1901, these being the weights of ratios at ages for Method A (comparison by the ordinary standardized

death-rate) and also the death-rates at ages which are the weights of ratios on the present method. Table XI shows the actual ratios of the sub-death-rates on those for 1901. Table XII gives the summary comparison. In the first line is the comparison by the standardized death-rates, showing falls over the whole 30 years

TABLE X: (1) Expected deaths in the Standard Population of 1901 (Persons) on the basis of the respective death-rates for Males and for Females in that year shown in the next columns. (2) The death-rates per 1000 living at each age in England and Wales 1901.

Ages at Death.	Expected Deaths in 1,000's: 1901.		Death-rates per 1,000 : 1901.	
	M.	F.	M.	F.
0-	219	184	59·0	49·5
5-	14	14	4·0	4·1
10-	8	8	2·3	2·4
15-	11	10	3·5	3·2
20-	15	12	4·7	3·8
25-	33	28	6·2	5·3
35-	42	35	10·6	8·7
45-	52	40	18·0	13·8
55-	65	51	33·5	26·5
65-	73	61	67·8	56·5
75-	55	48	139·8	122·6
85 up	13	12	276·5	247·1
Total... ..	600	503	—	—

TABLE XI: Showing the proportions of death-rates at ages in each sex in England and Wales in 1911, 1921 and 1931 to those in 1901 taken as 100.

Ages at Death.	Males.				Females.			
	1901.	1911.	1921.	1931.	1901.	1911.	1921.	1931.
0-	100	79	55	38	100	80	52	35
5-	100	87	70	57	100	83	66	49
10-	100	91	78	65	100	87	75	62
15-	100	89	80	74	100	84	84	75
20-	100	81	77	68	100	87	84	76
25-	100	81	68	56	100	79	70	62
35-	100	76	61	55	100	76	60	52
45-	100	83	63	64	100	83	64	59
55-	100	88	73	70	100	86	69	65
65-	100	92	82	89	100	89	77	82
75-	100	98	92	101	100	94	89	97
85 up	100	97	95	105	100	93	94	114

TABLE XII: Comparison of mortality in 1911, 1921 and 1931 with mortality in 1901, taken as 1000, by (1) Method A, standardized death-rate; (2) Method C (method of equivalent average death-rate), for each sex.

	Males.				Females.			
	1901.	1911.	1921.	1931.	1901.	1911.	1921.	1931.
Standardized death-rate	1,000	843	676	616	1,000	839	658	594
Method C :								
0-65	1,000	830	649	575	1,000	822	629	541
65-85	1,000	959	889	973	1,000	925	851	927
0-85	1,000	916	808	839	1,000	891	780	802

in the proportion of 1000 : 616 for males and 1000 : 594 for females.* In the next three lines are given comparisons by the present method, for the age periods 0-65 and 65-85 separately and for 0-85 as a whole in the bottom line. It is obvious that, on the present method, taking nearly the whole range of life from birth to advanced age gives quite a misleading impression. The result is so over-weighted by the high death-rates of advanced life that in both sexes the figures suggest a rise of mortality between 1921 and 1931 (808 to 939 for males, 780 to 802 for females), though actually the only age-groups showing a rise are 45-, 75- and 85 upwards for males, and 65-, 75- and 85 upwards for females. As a matter of fact the age-groups over 65 account for roundly two-thirds of the total weight for ages 0 to 85, as may be verified from Table X.

But, *per contra* do the figures 616 and 594 given by the standardized death-rates really seem reasonable when we look at the ratios for individual ages in Table XI? A lower percentage figure than 61.6 is only shown by the males in age-groups 0-, 5-, 25- and 35- : that is, over 30 years of life. A lower percentage figure than 59.4 is only shown by the females in age-groups 0-, 5-, 35- and 45- : that is again over 30 years of life. Surely that is not very reasonable? When we consider the matter, is not the weighting in this case a bit overdone just at the other end of life? For both sexes, over 36 per cent. of the total weight is allocated to the one age-group 0-5 years. On Method C it only gets between 9 and 10 per cent. of the total between ages 0 and 85.

Turning now to the other two lines for the present method, showing the results separately for 0 to 65 and 65-85, the first, it seems to me, gives a fair impression of the state of affairs over the

* The standardized rates given in the Review are only carried to the first decimal per 1000 and the proportions per 1000 in Table XII are probably not exact.

bulk of life. The figure for males in 1931 is 575. The figures in Table XI under 65 years of age are lower than this over 30 years of life and higher over 35 years of life. The figure for females in 1931 is 541, and this seems low. The figures in Table XI under 65 years of age are lower than this over 20 years of life and higher over 45. The mortality of infancy and early childhood (0-5) gets some 28 per cent. of the weight now that we have eliminated the high death-rates of old age. The line giving the figures for ages 65-85 needs little comment: it seems quite well to reflect the relatively small changes that have taken place.

It appears to me that figures so determined for ages 0-65 and 65-85 would be quite fair indexes to the course of mortality. The present method of standardization would itself gain if standardized rates were stated separately for the same age-groups. I have been struck by the usefulness of such a separation in recent tables for special diseases given in the *Text* of the *Statistical Review*. Even the omission of the unanalysed age group "85 and upwards" in this method would be quite justifiable, for it is obvious that possible changes in its age composition render changes in its death-rate of doubtful significance. But these changes affect the total with so small a weight (little more than 2 per cent.) that the matter is of no practical consequence.

This must suffice for illustration. The method seems at least worth discussing. It is extraordinarily simple and comprehensible, completely free from the necessity for assuming any arbitrary standard, and the ratios it yields are perfectly comparable with each other: they are comparable, that is to say, as *ratios of averages* of the sub-death-rates. It might have attracted even Dr. Brownlee, as bringing standardization proper into relation with the life-table.

The methods that might be proposed are obviously innumerable and I have looked at more than one. But all others that have occurred to me seemed to fail on some desideratum; usually they fail to be readily comprehensible.

Section II. *Standard Errors of Comparative Mortality Figures.*

In 1916 Professor Pearson and Dr. Tocher published in *Biometrika* (vol. xi, p. 159) an article "On criteria for the existence of differential death-rates," dealing with the general problem "Can two populations dying in a known manner during a given period be considered as samples drawn from the same material?" This paper had entirely escaped my memory, and Professor Greenwood reminded me of it after reading the present paper in proof. I greatly regret this failure of memory, for the paper deals with a problem very close

to my own and treats the problem and its difficulties much more fully: the reader should certainly refer to it. At the same time the approach was not precisely mine, for I wished definitely to determine standard errors for the C.M.F.'s.

So far as I know, no one has yet discussed the standard errors of Comparative Mortality Figures. But when we are dealing with occupational mortality it seems very desirable that we should have at least some notion as to their magnitude, for the basis of the C.M.F. is not infrequently rather uncomfortably small as regards both deaths and population—even when we consider the total mortality from all causes. If we proceed further and consider the contributions to the C.M.F. from individual causes the basis may be very small indeed, so far as deaths are concerned.

Admittedly the application of the ordinary formulæ of simple sampling to the case of death-rates is dangerous, for the conditions assumed are not fulfilled. (1) The chance of death, within say a year, is not the same for every individual even within one age-group in one occupation; the group is never homogeneous. (2) The chance of death is never constant from year to year; one year, *e.g.*, may have an influenza epidemic, the next may not, so that fluctuations due to definite causes are superposed on fluctuations of simple sampling: and the same sort of thing holds for differences of place, and hence of occupation, as well as of time. (3) For certain causes, *e.g.* infectious diseases and accidents likely to be fatal to many at once, the contributions to the sample are not independent of one another, but are positively correlated. The first breach of conditions tends to lower the standard error relatively to that given by the formulæ of simple sampling: both the last two tend to raise it. The latter effect must, I think, tend far to outweigh the first, and in general we would be wise to regard the s.e. as giving no more than a lower limit of uncertainty.

In the present section I limit myself specifically to the case of occupational mortality and the methods there used, or which might be used, like my suggested Method C. This enables me to make a great simplification, without, I think, an undue loss of accuracy, on the assumption that the population in any occupation is small compared with the large Standard Population, and its death-rates of the same order of magnitude. This amounts to assuming that the standard error of the denominator of the C.M.F. may be regarded as small compared with that of the numerator, so small that its contribution to the s.e. of the fraction may be neglected: the denominator may, in effect, be regarded as a constant. Anyone who mistrusts the approximation may proceed from the formulæ given by further calculating (1) the s.e. of the denominator also,

(2) the correlation between numerator and denominator, remembering that the correlation between the sub-death-rate of the occupation and that of the S.P. is given by the square root of the proportion that the sub-population of the occupation bears to that of the S.P., and then evaluating the true s.e. of the C.M.F., say $z = u/v$, by the formula—

$$\frac{1}{z^2} \varepsilon_z^2 = \frac{1}{u^2} \varepsilon_u^2 + \frac{1}{v^2} \varepsilon_v^2 - 2 \frac{r_{uv}}{uv} \varepsilon_u \varepsilon_v \quad . \quad . \quad . \quad (20)$$

Owing, however, to ε_u being large compared with ε_v , the third term exceeds the second and the actual effect of the longer work is merely slightly to *reduce* the value found for the standard error. We are on the safe side in using the approximate formulæ.

A. *The fixed base method*: C_1 . In practice we do the arithmetic by multiplying the sub-death-rates for the occupation, not by the actual sub-populations of the S.P., but by reduced populations which would give 1000 deaths at the sub-death-rates for that population. Let us denote these reduced populations by w_r . Then the square of the s.e. of m_{ur} is $m_{ur}(1 - m_{ur})/p_{ur}$: the square of the s.e. of its contribution to the C.M.F. is given by multiplying this by w_r^2 , and hence the square of the s.e. on our limiting assumption is given by

$${}_1\varepsilon_u^2 = S_r \left(\frac{m_{ur}(1 - m_{ur})}{p_{ur}} w_r^2 \right) \quad . \quad . \quad . \quad (21)$$

S_r denoting as before, summation for all values of r , i.e. summation over all age-groups.

I took two cases to test the accuracy of this approximate formula, viz. the large occupational group 7. *Coal-mine—Hewers and Getters*, all fields together, in which the number of years of life at risk between the ages 20 and 65 is 1,405,182 and the very small sub-group 14a. *Miners and Quarriers of Igneous Rocks (not Granite)*, in which the number of years of life at risk is only 8,724.

In the first case the C.M.F. is 938, and (21) gave me 9·83 as the approximate value for the standard error. The same equation gave 1·923 as the s.e. of the C.M.F. for the Standard Population, that is to say, this would be the standard deviation round 1000 of the numbers found, by a calculation precisely similar to that done for the occupation, if we could take a series of samples of the same size as the S.P. from a universe precisely similar but indefinitely larger. For r_{uv} I found the value 0·190, quite a close approximation to which one might have got simply by taking the root of the proportion 1,405,182/29,114,580 (the denominator being the number of years of life at risk in the S.P.), viz. 0·220: actually, however, one does not require the correlation, but the product $r_{uv}\varepsilon_u\varepsilon_v$ which

is obtained directly and comes to 3.5887. Equation (20) then gave for the more precise value of the s.e. 9.66, or 0.17 less than the value found by (21). This is probably the greatest error that occurs.

In the second case the C.M.F. is 573 and the s.e. by (21) is 82.66. For r_{uv} I found the value 0.0554—against 0.0547 by taking simply the square root of 8,724/29,114,580—or 8.8124 for the product $r_{uv}e_u e_v$. Equation (20) then gave for the more precise value of the standard error 82.61, against the value of 82.66 by (21). Most errors are likely to be of the value 0.1 or less, and are hardly material.

B. *The changing base method*: C_2 . The ratio of mortalities is here taken as given by

$$\frac{S_r(d_{ur})}{\bar{S}_r(m_{ur}p_{ur})},$$

which may be briefly denoted by D_u/sE_u . The square of the standard error of the deaths in any one sub-group, d_{ur} , is given by

$$p_{ur}m_{ur}(1 - m_{ur}).$$

Hence the standard error of the numerator is given by

$$\varepsilon_{D_u}^2 = S_r[p_{ur}m_{ur}(1 - m_{ur})] \quad . \quad . \quad . \quad (22)$$

and if we may again ignore the contribution of the denominator to the standard error, the s.e. of C_2 is given by the equation

$$\varepsilon_{C_2}^2 = \frac{10^6}{sE_u^2} S_r[p_{ur}m_{ur}(1 - m_{ur})] \quad . \quad . \quad . \quad (23)$$

where the factor 10^6 is introduced on the assumption that as usual we make the basis 1000 and not unity.

I again tested the closeness of approximation on occupational groups 7 and 14a, using equation (20). The s.e. of the denominator is of the same form as that for the numerator, and the correlation term must be evaluated directly. The complete process, which requires more than double the labour, gave a value of 9.01 for the standard error of C_2 for occupation 7 (918) against 9.22 by equation (23). For occupation 14a, the complete process gave a value of 81.76 for the standard error of C_2 (569) against 81.82 by equation (23). Again, most errors may be assumed to be of the order 0.1 or less—and they are on the safe side.

Quite a close approximation to the value of the standard error may be made very simply indeed, for the s.e. of D is very nearly its own square root: hence approximately

$$\varepsilon_{D_u} = 1000\sqrt{D_u/sE_u} \quad . \quad . \quad . \quad (24)$$

The formula gives a value of 9.27 for 7. Hewers and 82.11 for 14a. Quarriers of Igneous Rocks (not Granite), a value in each case

slightly higher even than that given by equation (23) but quite close enough for many practical purposes. It is a most useful result for rough work, but must be applied with caution where mortality is high.

C. *The method of equivalent average death-rates*: C_3 . The ratio of mortalities now is given by equation (19) of Section I or

$${}_sR_u = \frac{S_r(h_r m_{ur})}{S_r(h_r m_{sr})} = \frac{k_u}{k_s} \quad . \quad . \quad . \quad (25)$$

where we have introduced the new symbols k_u , k_s for the sums in the numerator and denominator for the sake of brevity. The square of the s.e. of k_u is given by

$$\varepsilon_{k_u}^2 = S_r \left[\frac{h_r^2 m_{ur} (1 - m_{ur})}{p_{ur}} \right] \quad . \quad . \quad . \quad (26)$$

and hence, again on the assumption that the contribution of the denominator to the s.e. may be neglected, we have for the square of the s.e. of C_3 ,

$$\varepsilon_{C_3}^2 = \frac{10^6}{k_s^2} S_r \left[\frac{h_r^2 m_{ur} (1 - m_{ur})}{p_{ur}} \right] \quad . \quad . \quad . \quad (27)$$

Trial on the same two occupational groups as before showed that the errors introduced by the approximate procedure were just of the same order of magnitude as in the preceding cases. For 7. Coal-hewers ($C_3 = 961$) the more exact but more lengthy procedure gave an s.e. of 11.01, against 11.19 by the approximate formula above. For 14a, the group of Quarriers, C_3 was 545: the s.e. found by the exact procedure was 78.64, by the approximate formula (27) 78.69. In this case also errors will commonly be of the order 0.1 or less and on the safe side.

But the necessary condition must, of course, be fulfilled, that the population of the group must be small compared with that of the Standard Population, i.e. *All Occupied and Retired Civilian Males*. If too large a group be taken, the error will become very appreciable. Social Class III (Skilled Workers) is the largest social class, the years of life at risk being 12,656,145 against 29,656,145 for the Standard Population, so that its population is 43.5 per cent. of the latter. Its C.M.F. is 951. The standard error by the approximate formula (21) comes to 2.94, by the complete process to 2.26 only.

In Table XIII I give, for the same fifty occupations as in Table VIII, the values of the three C.M.F.'s and their standard errors and, in order to give some idea as to the magnitude of the basis, the numbers of years of life at risk and of deaths. Comparing first

the magnitudes of the three standard errors for the C.M.F.'s of any one occupation with each other, we note that as a rule they do not greatly differ. Only in a few instances are the differences large, the most notable being that of the erratic Barristers (137), where the occurrence of one death in the age-group 20—against an expectation of 0.36 completely upsets not only the coefficients but also their calculated s.e.'s, which themselves are biased by the bias of the sample. Putting aside for the moment a more detailed comparison of the relative magnitudes, let us look at the actual magnitudes of the standard errors. There are but three groups in which an error of the magnitude of the s.e. would affect only the last digit of any C.M.F., viz. 1. Farmers, 5. Agricultural Labourers and 164. General Labourers, the years of life in these three occupations being roundly 800,000, 1,178,000 and 1,821,000 respectively. Though the years of life for 7. Hewers and Getters (all) exceed the first two figures, their s.e.'s are higher: in the cases of Farmers and Agricultural Labourers the lower populations are compensated by lower values of the C.M.F.'s. Even in the larger occupations in which the years of life run to 100,000 or 200,000, the tens-figure of the C.M.F.—corresponding to a unit of percentage—would be affected by some one to three units. When we come to the very small groups with only a few thousand years of life at risk (13a, 14a, 14c, 38, 51, 101, 135, 137) an error of the magnitude of the s.e. would affect the tens-figure of the C.M.F. largely, or even affect the hundreds-figure by one to three units. In dealing with these smaller groups—often some of the most interesting—we must clearly be careful to allow a large margin for fluctuations of sampling: it would be safer, for example, to think of the figure for Tin Miners as something like 4300 ± 300 .

Let us return now to the question of the relative magnitudes of the s.e.'s for the three coefficients. A more detailed study of the table shows that sometimes one is the greatest and sometimes another; on the whole the s.e. of C_2 seems most frequently to be the smallest, but the relative magnitudes of the s.e.'s of C_1 and C_3 fluctuate a good deal. In any such consideration it is as well to block out the sub-groups 7a–7n, since for the most part they simply repeat the order of the total group 7, their populations being very similar as regards age-distribution. Omitting these and also groups 1, 5, 13a, 15, 31, 81, and 164, in which unfortunately the s.e.'s of two coefficients are equal to each other, to the degree of accuracy given, we are left with 29 occupations for which we may tabulate the order of the s.e.'s as regards magnitude. Using 1 to denote the smallest s.e. and 3 the largest, in Occupation 2 for example the s.e.'s are 12.0, 11.0, 11.2, and we may tabulate this as 312: in

TABLE XIII : The three Comparative Mortality Figures and their standard errors for 50 occupations : with the years of Life at Risk and the number of Deaths between ages 20 and 65.

1.	2.	3.	4.	5.	6.	7.	8.	9.
Occupation.	Years of Life, 20-65.	Deaths, 20-65.	C ₁ .	s.e.	C ₂ .	s.e.	C ₃ .	s.e.
1. Farmers and their relatives	800,244	5,761	674	9.1	671	8.8	672	8.8
2. Gardeners and their labourers	489,219	3,905	707	12.0	690	11.0	698	11.2
3. Farm Bailiffs and Foremen	63,060	374	526	28.7	543	27.9	546	29.1
4. Woodmen and Labourers in woods and forests	27,888	214	714	50.9	681	46.3	681	46.6
5. Agricultural Labourers (including Shepherds)	1,177,047	7,943	688	7.8	688	7.7	681	7.7
7. Coal-mine—Hewers and Getters—all	1,405,182	9,788	938	9.8	918	9.2	961	11.2
7a. " Northumberland	66,129	422	830	41.8	823	39.8	848	47.4
7b. " Durham	182,541	1,147	824	25.5	823	24.2	832	28.8
7c. " Cheshire and Lancashire	143,790	1,278	1,109	31.3	1,080	29.9	1,155	35.3
7d. " Yorkshire : West Riding	234,324	1,772	975	23.9	970	22.9	981	26.8
7e. " Nottinghamshire	81,255	481	831	39.6	805	36.5	851	45.0
7f. " Derbyshire (excluding South Derby) ...	93,543	526	776	35.2	761	33.0	788	39.6
7g. " North Staffordshire	48,531	328	1,015	60.7	973	53.4	1,052	71.0
7h. " Staffordshire (excluding N. Staffs.) :								
Shrops. : Worcester	65,016	473	945	44.3	925	42.2	977	49.9
Leicester, Warwick, South Derby	56,583	296	763	48.3	749	43.3	782	56.4
7i. " Glamorgan	221,592	1,612	1,001	25.9	962	23.8	1,042	29.8
7k. " Monmouth	88,959	590	923	40.1	915	37.4	938	45.7
7l. " Brecknock, Carmarthen, Pembroke	33,300	258	1,135	78.0	1,113	69.0	1,174	92.3
7m. " Cumberland	17,121	128	960	90.0	1,022	89.9	912	97.4
7n. " Gloucestershire, Somerset	27,675	160	817	66.5	773	60.7	857	76.0
11. Coal-mine—workers above ground, not superintend- ing staff	228,258	2,562	1,183	23.3	1,179	23.1	1,163	23.2
13a. Tin and Copper Miners—underground workers, not superintending staff	5,325	189	4,335	306.1	4,265	306.1	4,344	322.0

TABLE XIII.—(continued).

1.	2.	3.	4.	5.	6.	7.	8.	9.
Occupation.	Years of Life- 20-65.	Deaths 20-65.	C ₁ .	s.c.	C ₂ .	s.c.	C ₃ .	s.c.
14a. Miners and Quarriers of Igneous Rocks (not Granite)	8,724	48	573	82.7	569	81.8	545	78.7
14b. Limestone Miners and Quarriers	25,674	221	918	61.5	913	61.1	892	61.4
14c. Sandstone Miners and Quarriers	10,884	196	1,644	120.6	1,659	116.6	1,702	121.4
15. Slate Miners and Quarriers	16,473	167	944	73.9	964	73.9	984	75.9
21. Brick, Tile, etc., Oven and Kiln men	14,562	120	878	80.0	881	79.8	921	87.9
31. Smiths and skilled Forge-workers	318,462	2,924	951	17.5	954	17.5	969	18.2
38. File-cutters	4,275	80	1,851	207.2	1,831	201.8	1,814	201.0
41. Metal Glazers, Polishers, Buffers, and Moppers	26,670	300	1,443	86.8	1,451	83.1	1,436	97.4
61. Cotton Blow-room Operatives—skilled	8,166	118	1,516	138.3	1,515	137.9	1,507	140.1
61. Woollen and Worsted Weavers	24,093	283	1,082	66.2	1,094	64.4	1,104	65.1
71. Skilled Boot and Shoe Operatives—not clickers and cutters	87,621	902	1,120	37.1	1,120	37.0	1,108	38.1
81. Sawyers, Wood-turners and Machinists	107,148	826	868	30.0	867	30.0	860	31.1
91. Bricklayers	222,771	2,078	854	19.6	863	18.8	866	19.4
101. Drafters and Brushmakers	10,134	132	1,320	115.8	1,258	108.6	1,224	106.1
111. Livery Stable and Motor Garage Proprietors; Haulage Contractors	106,929	813	791	28.0	788	27.5	796	28.7
121. Messengers, Hall Porters, Lift Attendants, etc.	81,393	976	1,200	38.8	1,164	35.8	1,148	36.5
131. Auctioneers, Appraisers, Valuers	40,404	469	1,031	52.4	1,015	46.5	1,025	48.5
134. Clergymen (Anglican Church)	56,853	467	561	28.8	605	27.8	579	27.3
135. Roman Catholic Priests: monks	8,271	75	780	90.2	815	93.3	821	95.1
136. Ministers of other religious bodies	27,381	235	639	43.5	704	44.8	683	44.9
137. Barristers	8,715	119	1,171	178.4	1,063	96.6	1,124	136.6
138. Solicitors	41,970	513	899	54.3	945	41.3	920	46.5
139. Registered Medical Practitioners	67,335	828	1,021	45.8	1,016	35.0	1,023	39.6
140. Dentists	25,732	201	910	65.9	919	64.5	901	69.5
141. Teachers (not music teachers)	202,029	1,447	736	20.8	715	18.7	737	20.2
151. Gamekeepers	24,411	180	667	53.7	648	48.1	662	50.7
161. Storekeepers	100,500	908	952	31.6	950	31.3	933	32.0
164. General and undefined labourers	1,820,937	25,694	1,438	8.9	1,431	8.8	1,419	8.9

Occupation 3 they are 28·7, 27·9, 29·1, which we may tabulate as 213. The following table then summarizes the results for the six possible orders.

Order.					Frequency.
123	...	...	..	..	2
132	...	...	...	..	—
213	...	...	...	...	10
312	...	...	...	...	13
231	...	...	...	...	—
321	...	...	...	..	4
Total	...	...	..	..	29

The orders 213 and 312 are by far the most frequent, and confirm the impression by mere inspection that the s.e. of C_2 is most usually the lowest, while C_1 and C_3 fluctuate in relative precision.

TABLE XIV: Age distributions of populations used for experimental tests on the s.e.'s of C.M.F.'s, the population having a total 1/1000th of that of the S.P., but either maintained in the original distribution or redistributed in various ways to give more or less of the old and the young. Actual population 29,115.

Age Distributions of Population per 1,000.						
Age Group.	Standard Population. 1.	More Old.		Fewer Old.		
		Fewer Young. 2.	More Young. 3.	More Young. 4.	Fewer Young. 5.	
20-	138	35	200	344	35	
25-	259	122	200	293	190	
35-	250	250	200	250	525	
45-	215	284	200	78	181	
55-	138	309	200	35	69	
Total	1,000	1,000	1,000	1,000	1,000	

C.M.F.		Standard Errors of the three coefficients and their numerical order : 1 = lowest, 3 = highest							
C_1	...	60·81	2	61·06	3	59·66	3	97·50	2
C_2	...	60·81	1	50·33	1	57·43	1	76·78	1
C_3	...	62·97	3	53·58	2	57·90	2	113·00	3

Not finding it possible, by consideration of the formulæ, to arrive at any general results as to the effect of varying the age-

distribution of the population, I tried to throw some light on the subject by trial. I first assumed that the group had a population (years of life at risk) $1/1000$ th of that of the S.P. (*i.e.* 29,115 to the nearest unit) and that its death-rates were identical with those of the S.P., so that all C.M.F.'s were 1000. For such a group I found the s.e.'s (Table XIV, Col. 1) were 60.81, 60.81, 62.97 respectively: actually the first standard error was slightly greater than the second, though the difference probably lies within the possible inaccuracy of my arithmetic, so I called the order 213—but this approximate equality of the s.e.'s for C_1 and C_3 is not at all characteristic of the figures in Table XIII. I accordingly tried the effect of greatly varying the age-distribution, by pushing more of the population on to the older or the younger age-groups, while still maintaining the same total, thus getting the distributions per 1000 shown in columns 2 to 5 of Table XIV. The corresponding standard errors and their orders are shown in the bottom half of the table. It will be seen that an excess of the more aged gives the order 312, whether the numbers of the younger are relatively increased or decreased, while a deficiency of the older in either case gives the order 213.

Extracting then the ten occupations giving the order 213, dominated by the Hewers who contribute 76 per cent. of the years of life at risk, and the thirteen giving the order 312, I totalled their populations (years of life at risk) separately. Reducing the age-distributions to totals of 1000, they were as follows.

Age-group.				Order of s.e.'s.	
				213.	312.
20—	...	...	...	144	86
25—	...	...	...	306	209
35—	...	...	...	261	252
45—	...	...	...	196	249
55—	...	...	...	93	204
Total	...	...	...	1,000	1,000

Comparing with the first column of Table XIV, we see that the results are in complete accordance with those of the test experiment. In the first group there is a deficiency, as against the S.P., in both the older age-groups, while in the second group there is an excess. I have not gone through the labour of verifying how far the same holds good for every occupation within reach of the respective groups, but clearly we may conclude that the precision of C_3 tends to be less than that of C_1 when there is a

deficiency of the more aged, and greater in the converse case. The conclusion seems reasonable when we remember that C_3 is relatively more dependent on the death-rates in the older age-groups.

The two occupations giving the very exceptional order 123 are 135. R. C. Priests and 136. Ministers of other religious bodies. The order of the s.e.'s may perhaps be accounted for by the fact that both groups show no deaths in the age-group 20-, against respective expectations of 0.65 and 0.89, so that the calculated s.e. is thrown down; just as in the converse case of the Barristers the occurrence of one death when the expectation is only 0.36 throws it up. I should be very much inclined in such a case to throw a fractional death into the empty group and re-calculate the s.e.

The four occupations giving the order 321 are 14a. Quarriers of igneous rocks, 38. File Cutters, 101. Drafters and brushmakers, and 134. Clergymen (Anglican). They are a very heterogeneous lot both as regards mortality and age-distribution of population. All the populations are, however, of the age-type with a deficiency of the young and an excess of the old, which would normally give the order 312. Evidently here the other factor takes effect—the relative magnitudes of the death-rates at ages: but I can throw no further light on the matter. Mistaken arithmetic may, I think, be excluded. As a check, I worked out the standard errors of the three C.M.F.'s for the pool of the three first (14a, 38 and 101). They came to 71.02, 68.50 and 62.07. Some age-distributions of population and sets of death-rates may then render C_3 the least affected by fluctuations of sampling of the three C.M.F.'s.

The above will suffice for illustrations of the magnitudes of standard errors of the total C.M.F.'s, for all causes of death, of the three forms discussed. It may be as well to add an illustration of the standard errors of the partial C.M.F.'s, of the common form C_1 , for the several distinct causes of death. For this purpose I have chosen data from a recent paper by Professor Collis and myself,* in which we discussed the mortality of an occupational group exposed to silica dust, compared with that of the general population on the one hand, and with that of an occupational group exposed to dust containing little or no silica on the other. We based our discussion on the 1921-3 Report: the general population is, of course, the Standard Population of All Occupied

* E. L. Collis and G. U. Yule, "The mortality experience of an occupational group exposed to silica dust, compared with that of (i) the general population, and (ii) an occupational group exposed to dust not containing silica," *Journal of Industrial Hygiene*, Nov. 1933.

TABLE XV: Showing the contributions to the C.M.F. for each cause of death, with their standard errors, for (1) S.P. the Standard Population, (2) S. a group of six occupations exposed to silica dust, (3) N.S. a group of five occupations exposed to dust containing little or no silica. Data of 1921-3. A dash means no deaths. (C.M.F.'s cited from Collis and Yule, *loc. cit.*) Years of life at risk (ages 20-65). S group 118,593; N.S. group 99,789.

Cause of Death.	Group.	Number of Deaths, 20-65.	C.M.F.	s.e.
1. Influenza	S.P.	9,726	36.5	0.37
	S.	51	47.1	6.63
	N.S.	47	49.6	7.27
2. Respiratory tuberculosis	S.P.	43,550	163.5	0.78
	S.	654	592.2	23.15
	N.S.	162	172.4	13.59
3. Other tuberculosis	S.P.	3,690	13.9	0.23
	S.	34	31.2	5.38
	N.S.	13	14.2	3.96
4. Syphilis, etc. (including tabes dorsalis, G.P.I. and aneurysm)	S.P.	7,261	27.3	0.32
	S.	27	24.6	4.75
	N.S.	19	19.4	4.46
5. Cancer—all sites	S.P.	34,171	128.3	0.60
	S.	176	166.6	12.57
	N.S.	107	109.3	10.56
6. Chronic rheumatism, etc.: gout	S.P.	907	3.4	0.11
	S.	14	13.6	3.65
	N.S.	3	3.2	<i>a</i>
7. Diabetes	S.P.	3,186	12.0	0.21
	S.	13	12.6	3.50
	N.S.	9	9.4	3.15
8. Alcoholism	S.P.	286	1.1	0.06
	S.	1	1.0	<i>b</i>
	N.S.	—	—	<i>c</i>
9. Cerebral hæmorrhage, etc.	S.P.	12,001	45.1	0.41
	S.	75	72.0	8.33
	N.S.	39	39.6	6.35
10. Other diseases of the nervous system	S.P.	8,384	31.5	0.36
	S.	52	48.6	6.77
	N.S.	27	27.7	5.34
11. Valvular disease of the heart	S.P.	16,948	63.6	0.49
	S.	105	99.6	9.75
	N.S.	58	61.1	8.05
12. Other heart disease	S.P.	17,256	64.8	0.49
	S.	107	101.4	9.83
	N.S.	55	57.6	7.78

TABLE XV.—(continued).

Cause of Death.	Group.	Number of Deaths, 20-65.	C.M.F.	s.e.
13. Arterio-sclerosis	S.P.	5,471	20.5	0.28
	S.	39	38.6	6.19
	N.S.	19	19.0	4.35
14. Other diseases of the circulatory system	S.P.	709	2.7	0.10
	S.	1	1.0	<i>d</i>
	N.S.	4	4.0	<i>e</i>
15. Bronchitis	S.P.	13,212	49.6	0.43
	S.	221	214.0	14.38
	N.S.	59	59.5	7.74
16. Pneumonia	S.P.	22,715	85.3	0.57
	S.	148	134.3	11.07
	N.S.	73	76.0	8.90
17. Chronic interstitial pneumonia	S.P.	377	1.4	0.07
	S.	59	54.8	7.16
	N.S.	12	12.3	3.55
18. Other diseases of the respiratory system	S.P.	4,226	15.9	0.24
	S.	40	37.6	5.97
	N.S.	17	17.9	4.35
19. Ulcer of the stomach	S.P.	2,778	10.4	0.20
	S.	17	15.1	3.67
	N.S.	12	14.6	3.93
20. Ulcer of the duodenum	S.P.	1,525	5.7	0.15
	S.	8	7.0	2.47
	N.S.	1	1.1	<i>f</i>
21. Appendicitis	S.P.	2,352	8.8	0.18
	S.	11	10.2	3.11
	N.S.	3	3.5	<i>g</i>
22. Hernia	S.P.	879	3.3	0.11
	S.	11	10.4	3.15
	N.S.	4	4.0	<i>h</i>
23. Intestinal obstruction	S.P.	1,381	5.2	0.14
	S.	3	2.6	<i>i</i>
	N.S.	3	3.4	<i>j</i>
24. Cirrhosis of the liver	S.P.	2,545	9.6	0.19
	S.	14	13.0	3.50
	N.S.	1	1.1	<i>k</i>
25. Other diseases of the digestive system	S.P.	4,499	16.9	0.25
	S.	19	17.2	3.97
	N.S.	12	12.9	3.75
26. Acute nephritis	S.P.	1,163	4.4	0.13
	S.	4	3.9	<i>l</i>
	N.S.	2	2.2	<i>m</i>

TABLE XV.—(continued).

Cause of Death.	Group.	Number of Deaths, 20-65.	C.M.F.	s.e.
27. Chronic nephritis	S.P.	9,262	34.8	0.36
	S.	54	50.6	6.90
	N.S.	25	26.3	5.27
28. Diseases of the prostate	S.P.	978	3.7	0.12
	S.	6	5.8	<i>n</i>
	N.S.	1	1.1	<i>o</i>
29. Other genito-urinary diseases	S.P.	2,222	8.3	0.18
	S.	11	10.4	3.15
	N.S.	3	3.1	<i>p</i>
30. Old age	S.P.	438	1.6	0.08
	S.	2	2.0	<i>q</i>
	N.S.	2	2.0	<i>r</i>
31. Suicide	S.P.	6,475	24.3	0.30
	S.	41	37.7	5.92
	N.S.	18	18.4	4.34
32. Accident	S.P.	13,143	49.3	0.43
	S.	52	48.0	6.69
	N.S.	64	69.0	8.68
33. Other causes	S.P.	12,663	47.5	0.42
	S.	65	59.5	7.42
	N.S.	51	52.5	7.37
All causes	S.P.	266,384	1,000.0	1.92
	S.	2,135	1,984.4	42.35
	N.S.	927	967.2	31.64

The following are expected deaths on the basis of S.P. death-rates :

<i>a</i> 3.3 (in S. 3.6)	<i>f</i> 5.5	<i>k</i> 9.3	<i>p</i> 8.1 (in S. 9.0)
<i>b</i> 1.2	<i>g</i> 8.1	<i>l</i> 4.7	<i>q</i> 1.6
<i>c</i> 1.1	<i>h</i> 3.2	<i>m</i> 4.1	<i>r</i> 1.6
<i>d</i> 2.9	<i>i</i> 5.5	<i>n</i> 3.7	
<i>e</i> 2.6	<i>j</i> 4.9	<i>o</i> 3.7	

and Retired Civilian Males. The group exposed to silica dust was formed by the aggregate of the six occupations: 13*a*. Tin and Copper Mine—underground workers, not superintending staff; 18. Potters' Mill Workers; slip makers, potters; 20. Earthenware, China, etc. Kiln and Oven Men and Kiln Setters and Placers; 40. Metal Grinders; 14*c*. Sandstone Miners and Quarriers, and 94*b*. Sandstone Masons, Cutters and Dressers. The group exposed to dust containing little or no silica was formed by the aggregate of the five occupations: 17. Brick and Plain Tile-makers, Moulders, etc., Furnace and Crucible Pot-makers; 21. Brick, Tile, etc. Kiln and Oven Men; 12*b*. Iron Ore Mine—underground workers, not superintending staff—Staffordshire and

North Riding of Yorkshire; 14*b*. Limestone Miners and Quarriers; 94*a*. Limestone Masons, Cutters and Dressers. The three groups, Standard Population, Silica Group and Non-silica Group are denoted in brief by S.P., S., and N.S. in Table XV, in which three lines will be found opposite each cause of death, giving for each of the three groups (1) the number of deaths between ages 20 and 65 due to the cause, (2) the C.M.F., (3) its standard error—omitted, however, when the number of deaths is very small. In such cases the significance is best judged by a comparison of actual deaths with the deaths expected on the basis of the death-rates for the Standard Population, which are given in the footnotes.* As we saw above, the standard error of the number of expected deaths may be taken for all practical purposes as its square root, in spite of the fact that death-rates vary from age-group to age-group: that is to say, if the number of expected deaths be n and we take from a universe like the standard population a series of samples of such size that the number of expected deaths is n , the actual deaths will vary round n with a standard error approximately equal to the square root of n . Hence we can judge the probability of the observed number of deaths occurring as a mere chance fluctuation from the number expected. In the case of 6. *Chronic Rheumatism*, etc. the Non-silica Group shows 3 deaths, and footnote *a* tells us that the expectation is 3.3, so there is obviously nothing in the difference. If we pass to 20. *Ulcer of the duodenum*, the same group shows one death against an expectation of 5.5: the root of 5.5 is 2.35 and the difference from expectation some 1.9 times the s.e., so there are fair odds that the difference is significant. For 24. *Cirrhosis of the liver* the same group again shows only a single death against an expectation of 9.3 and the difference is certainly significant.

The standard errors hardly call for comment, but may serve as a useful supplement to the paper though they do not affect, I think, any of the conclusions. In the paper itself the general run of the figures at ages, and in some cases the death-rates in the age-group 65–70, were utilised, as I think they should be, in forming a judgment as to the real significance or otherwise of a difference.

Section III. *The Age Groups which afford the best indication of Occupational Mortality, and the interpretation of Mortality Ratios at Ages.*

It is familiar to everyone who is interested in our statistics of occupational mortality that in the last Report, on the data

* S.P. death-rates calculated to the nearest unit per million were used.

for 1921-3, Dr. Stevenson decided to include the age-group 20-25 in the basis of Comparative Mortality figures, instead of limiting that basis to the ages 25-65 as in previous Reports.

Singularly little discussion seems to have been given at any time to this rather important point—the ages that are best fitted to represent comparative occupational mortalities. In the Decennial Supplement for 1861-70, pp. clxxii *et seq.*, Table 63, Farr gives his principal table showing years of life, deaths and death-rates for the age-groups 15-, 20-, 25-, 35-, 45-, 55-, 65-, 75- for every occupation. The age-groups between the limits 25- and 55- inclusive are bounded by heavy rules and the heading placed between the rules “The Influence of Profession is most felt.” I find no discussion of the question in the text of the Report, but this seems clearly the start of the “25-65” tradition. In the Supplement for 1871-80 the main table, Table 6, pp. cxvii *et seq.*, gives the death-rates for the five age-groups 15-, 20-, 25-, 45-, 65 and upwards. In the text of the Report, p. xxiv, Dr. Ogle writes: “The rates have been calculated for five age-periods; but of these, the two which include the main working part of life, namely, the forty years which intervene between the 26th and 66th birthdays, are far more valuable and more trustworthy than the others; for not only are these the age-periods in which the numerical basis is as a rule the largest, but they are also the periods in which the influence of occupation is most marked. In the earlier age-periods the effect of occupation is not as yet fully developed; and the last age-period, 65 years of age and upwards, is that which is more especially affected by the disturbing cause previously noted, namely, the retirement from the industry of such men as have become too weakly to follow it. Although, therefore, the rates for each of the five age-periods are given in the fuller table, . . . in the following remarks and tables the rates for the two periods into which the great working part of life has been divided [that is 25-45 and 45-65] will alone be taken into consideration; and the differences presented by the several occupations within this restricted portion of life will be held to represent approximately the differences between them in regard to healthiness.” Dr. Ogle gave Comparative Mortality figures based on the two 20-year groups 25-45 and 45-65, and appears to be the originator of the method and the term. Dr. Tatham, in the Supplement for 1881-90, Part II, p. vii, after citing Farr’s heading and some sentences from Ogle, adds: “My own recent enquiries having tended to confirm the opinions expressed on this subject by my predecessors, I have . . . retained the same interval, namely, that between 25 and 65 years of age,

as marking the period of life during which the effects of occupation are most conspicuous"—though he points out that there are several industries, *e.g.* the learned professions, in which this is by no means the case. In the Supplement for 1891–1900, Part II, p. x, the same writer adds: "It may be remarked here that, on the one hand, young men before settling down to the business of life very commonly shift from one occupation to another; possessing generally a high degree of vitality, these young men would probably be capable of resisting for a time the unhealthy conditions of an employment, which conditions on this account might remain undetected. On the other hand, as the higher ages are reached, the effects of retirement whether from physical breakdown or from other causes become pronounced more and more strongly." In the Report on Occupational Mortality for 1910–12 Dr. Stevenson continued the limitation to ages 25–65. This limitation, he says, p. vi, "amongst other causes was due to the fact that the defects in the records of ages outside these limits were so great as to render their inclusion undesirable, and to the view that the years 25–65 are those in which the influence of occupation is most marked. The restriction at the lower ages doubtless minimizes the risk of the figures being coloured by the selective transfers which precede the settling down of the younger men to a single occupation. With regard to the higher age limit, it does not probably exclude any material amount of mortality from causes more directly attributable to occupation." Reference should also be made to the discussion of discrepancies between the return of occupation at the Census and on the death-certificate, as illustrated by the case of the Unoccupied, on pp. iv, v. The ratio of the actual deaths amongst the Unoccupied to the deaths expected according to the mortality rates for All Males are as follows:

15–25	...	...	...	...	4·55
25–45	...	...	...	...	2·26
45–65	...	...	...	...	0·66
65 up	...	...	...	...	0·14

It is obvious that the first figure, though it might be expected to be over unity, is absurdly high: Dr. Stevenson states that "many of the deaths of students or even apprentices have probably been assigned to the "unoccupied," whereas in the population figures such persons have been included amongst the occupied." The data therefore at these younger ages are more or less untrustworthy, and the same statement holds for ages over 65 where the reverse error comes into play. It is a little unfortunate that

the age-groups 15-20 and 20-25 were not distinguished in this comparison. Dr. Tatham gave in Part II of the Supplement for 1881-90, p. xiv, a comparison of the death-rates at ages (1890-92) for Occupied and Unoccupied or Retired * Males, as follows :

Age-group.	Death-rates per 1,000.		Ratio.
	Occupied.	Unoccupied or Retired.	
15-	2.55	35.86	14.06
20-	5.07	29.58	5.83
25-	7.29	27.05	3.71
35-	12.43	35.71	2.87
45-	20.66	37.77	1.83
55-	36.66	59.44	1.62
65 up	102.32	105.86	1.03

A ratio of nearly 6 for the age-group 20- seems much higher than is reasonable, and distinctly suggestive of untrustworthy data.

In the 1921-3 Report there is no real discussion of the change. All that Dr. Stevenson remarks (p. 117) concerning the introduction of the age-group 20- is : " This has been done in the belief that the average worker has at the age of 20 been sufficiently long subjected to the environmental influences of his occupation to make definite influence upon his mortality possible." But surely this is not the point. It may be at once conceded that there is a broad correlation between mortality in this age-group and status, which is brought out by large groupings of the occupations, such as that of the Social Classes. The following are the death-rates per 100,000 for the age-group 20- in these Classes :

Social Class I	...	...	...	...	237
Social Class II	...	...	...	...	307
Social Class III	...	...	...	...	347
Social Class IV	...	...	...	...	367
Social Class V	...	...	...	...	408

There is a continuous increase as we pass from the top to the bottom of the social scale. But it does not follow that the material is either trustworthy, or adequate to give reasonable figures for single occupations. The data cited above suggest untrustworthiness : very little investigation would have suggested that the data in this age-group are quite inadequate in many cases for individual comparisons. But apparently no investigation was made. In my opinion the inclusion of this age-group in the basis

* The misleading heading is simply " Unoccupied."

of the Comparative Mortality figure was a serious mistake. I am exceedingly sorry so to differ from a valued colleague who is no longer with us to defend his own views: but I do not differ from him wholly. I wish to appeal from his later view to his earlier view, the view of Farr, Ogle and Tatham.

TABLE XVI: Showing the number of occupations, in the 1921-3 Report, with 0, 1, 2, etc. deaths in the age-group 20-25. (Principal occupations only, omitting all sub-groups.)

Number of Deaths.				Number of Occupations with said Deaths.	Sum from Top.	Per cent.
0	...	...	...	5	5	3.0
1	...	...	...	6	11	6.7
2	...	...	...	4	15	9.1
3	...	...	...	7	22	13.4
4	...	...	...	6	28	17.1
5	...	...	...	5	33	20.1
6	...	...	...	9	42	25.6
7	...	...	...	2	44	26.8
8	...	...	...	6	50	30.5
9	...	...	...	2	52	31.7
10	...	...	...	4	56	34.1
11	...	...	...	4	60	36.6
12	...	...	...	3	63	38.4
13	...	...	...	1	64	39.0
14	...	...	...	1	65	39.6
15	...	...	...	2	67	40.9
16	...	...	...	—	67	40.9
17	...	...	...	2	69	42.1
18	...	...	...	2	71	43.3
19	...	...	...	1	72	43.9
20	...	...	...	2	74	45.1
21	...	...	...	2	76	46.3
22	...	...	...	—	76	46.3
23	...	...	...	—	76	46.3
24	...	...	...	2	78	47.6
25	...	...	...	7	85	51.8
26-30	...	...	...	9	94	57.3
31-35	...	...	...	10	104	63.4
36-40	...	...	...	2	106	64.6
41-45	...	...	...	1	107	65.2
46-50	...	...	...	8	115	70.1
51-100	...	...	...	23	138	84.1
101-200	...	...	...	15	153	93.3
201-300	...	...	...	3	156	95.1
301-400	...	...	...	1	157	95.7
401-500	...	...	...	1	158	96.3
501 upwards	...	...	...	6	164	100.0
Total	...	..		164	—	—

But none of these writers, though expressing opinions, supported them by any full statistical discussion. I have therefore thought it desirable to discuss the whole question in some detail.

I have thought it as well to include the age-group 65-70 in the discussion, for I have not infrequently found it necessary to bring the death-rates in this age-group into evidence.

TABLE XVII: Showing the number of occupations in the 1921-3 Report with 3, 4, 5, etc. deaths in the age-group 25-35.

Number of Deaths.	Number of Occupations with said Deaths.	Sum from Top.	Per cent.
3	1	1	0.6
4	2	3	1.8
5	—	3	1.8
6	2	5	3.0
7	5	10	6.1
8	2	12	7.3
9	1	13	7.9
10	1	14	8.5
11	—	14	8.5
12	3	17	10.4
13	6	23	14.0
14	4	27	16.5
15	3	30	18.3
16	3	33	20.1
17	4	37	22.6
18	4	41	25.0
19	1	42	25.6
20	3	45	27.4
21	—	45	27.4
22	3	48	29.3
23	2	50	30.5
24	1	51	31.1
25	1	52	31.7
26-30	9	61	37.2
31-35	1	62	37.8
36-40	5	67	40.9
41-45	2	69	42.1
46-50	8	77	47.0
51-100	31	108	65.9
101-200	25	133	81.1
201-300	13	146	89.0
301-400	6	152	92.7
401-500	1	153	93.8
501 upwards	11	164	100.0
Total	164	—	—

Let us first consider adequacy of material. So long as a death-rate is small, its standard error is given to a high degree of approximation by the square-root of the deaths, divided by the population; or the ratio of the standard error to the death-rate by the reciprocal of the square-root of the deaths. Hence *number of deaths* is the best indication of adequacy of material. Tables XVI to XXI show the frequency distributions of numbers of deaths in the successive age-groups 20-, 25-, 35-, 45-, 55-,

65-70, for the 164 principal occupations—excluding, that is to say, all sub-occupations denoted by a number with an *a*, *b*, or *c* suffix, so as to avoid weighting our results by the inclusion of minor groups. Little more than a glance at Table XVI is, as it seems to me, enough to condemn the inclusion of the age-group 20— in the basis of the C.M.F. In 85 of the 164 occupations, or over half, the number of deaths is 25 or less. Even for 25 deaths the standard error would be 20 per cent. of the death-rate: in some two-thirds of all cases fluctuations of sampling would lie within the limits ± 20 per cent., in rather more than a quarter they might run up to 40 per cent., and in rare cases to some 60 per cent. In 70 per cent. of all occupations the deaths are no more than 50, for which the standard error would be 14 per cent. What is the good of including an age-group providing in many instances material so inadequate as this?

TABLE XVIII: Showing the number of occupations in the 1921-3 Report with 8, 9, 10, etc. deaths in the age-group 35-45.

Number of Deaths.				Number of Occupations with said Deaths.	Sum from Top.	Per cent.
8	...	...	...	1	1	0.6
9	...	...	...	—	1	0.6
10	...	...	...	—	1	0.6
11	...	...	...	1	2	1.2
12	...	...	...	1	3	1.8
13	...	...	...	3	6	3.7
14	...	...	...	2	8	4.9
15	...	...	...	—	8	4.9
16	...	...	...	1	9	5.5
17	...	...	...	1	10	6.1
18	...	...	...	2	12	7.3
19	...	...	...	3	15	9.1
20	...	...	...	1	16	9.8
21	...	...	...	3	19	11.6
22	...	...	...	—	19	11.6
23	...	...	...	1	20	12.2
24	...	...	...	4	24	14.6
25	...	...	...	—	24	14.6
26-30	...	...	...	9	33	20.1
31-35	...	...	...	4	37	22.6
36-40	...	...	...	1	38	23.2
41-45	...	...	...	7	45	27.4
46-50	...	...	...	6	51	31.1
51-100	...	...	...	35	86	52.4
101-200	...	...	...	32	118	72.0
201-300	...	...	...	13	131	79.9
301-400	...	...	...	10	141	86.0
401-500	...	...	...	8	149	90.9
501 upwards	...	...	...	15	164	100.0
Total	...	...	...	164	—	—

TABLE XIX: Showing the number of occupations in the 1921-3 Report with 19, 20, 21, etc. deaths in the age-group 45-55.

Number of Deaths.				Number of Occupations with said Deaths.	Sum from Top.	Per cent.
19	...	...	...	1	1	0.6
20	...	...	...	—	1	0.6
21	...	...	...	1	2	1.2
22	...	...	...	—	2	1.2
23	...	...	...	—	2	1.2
24	...	...	...	—	2	1.2
25	...	...	...	—	2	1.2
26-30	...	...	...	5	7	4.3
31-35	...	...	...	6	13	7.9
36-40	...	...	...	4	17	10.4
41-45	...	...	...	8	25	15.2
46-50	...	...	...	6	31	18.9
51-100	...	...	...	36	67	40.9
101-200	...	...	...	33	100	61.0
201-300	...	...	...	14	114	69.5
301-400	...	...	...	14	128	78.0
401-500	...	...	...	6	134	81.7
501 upwards	...	...	...	30	164	100.0
Total	...	...	...	164	—	—

TABLE XX: Showing the number of occupations in the 1921-3 Report with 26-30, 31-35, etc. deaths in the age-group 55-65.

Number of Deaths.				Number of Occupations with said Deaths.	Sum from Top.	Per cent.
26-30	...	...	...	1	1	0.6
31-35	...	...	...	2	3	1.8
36-40	...	...	...	3	6	3.7
41-45	...	...	...	3	9	5.5
46-50	...	...	...	4	13	7.9
51-100	...	...	...	38	51	31.1
101-200	...	...	...	36	87	53.0
201-300	...	...	...	16	103	62.8
301-400	...	...	...	14	117	71.3
401-500	...	...	...	9	126	76.8
501 upwards	...	...	...	38	164	100.0
Total	...	...	...	164	—	—

Matters are quite bad enough in the following age-group 25-, Table XVII, even though here we are dealing with a ten-year (not a five-year) age-group and with a period of life when mortality is slightly higher. In over 30 per cent. of the occupations the deaths are still no more than 25, and in nearly half no more than 50. Even in the age-group 35-, Table XVIII, 24 or 15 per cent. of the occupations show no more than 25 deaths. In the age-group

45-, Table XIX, the number of occupations below this limit drops to 2, and in the following age-group 55-65, Table XX, to zero. These two age-groups are by far the most adequate in material.

TABLE XXI: Showing the number of occupations in the 1921-3 Report with 9, 10, 11, etc. deaths in the age-group 65-70.

Number of Deaths.				Number of Occupations with said Deaths.	Sum from Top.	Per cent.
9	...	...	...	1	1	0.6
10	...	...	...	—	1	0.6
11	...	...	...	—	1	0.6
12	...	...	...	1	2	1.2
13	...	...	...	—	2	1.2
14	...	...	...	2	4	2.4
15	...	...	...	—	4	2.4
16	...	...	...	—	4	2.4
17	...	...	...	—	4	2.4
18	...	...	...	—	4	2.4
19	...	...	...	—	4	2.4
20	...	...	...	1	5	3.0
21	...	...	...	—	5	3.0
22	...	...	...	1	6	3.7
23	...	...	...	2	8	4.9
24	...	...	...	—	8	4.9
25	...	...	...	1	9	5.5
26-30	...	...	...	7	16	9.8
31-35	...	...	...	4	20	12.2
36-40	...	...	...	8	28	17.1
41-45	...	...	...	9	37	22.6
46-50	...	...	...	3	40	24.4
51-100	...	...	...	42	82	50.0
101-200	...	...	...	28	110	67.1
201-300	...	...	...	16	126	76.8
301-400	...	...	...	8	134	81.7
401-500	...	...	...	8	142	86.6
501 upwards	...	...	...	22	164	100.0
Total	...	...	...	164	—	—

When we pass to the age-group 65-70, Table XXI, the distribution is again more scattered and the material less adequate, owing to our dealing with a five-year group and to the fact that population, in many occupations, is falling off rather rapidly. There are, however, only 9 occupations with no more than 25 deaths—as against 24 even in the age-group 35-. From the standpoint of numerical adequacy of material, as distinct from trustworthiness, this excluded age-group is better than three of those that are included.

So much for adequacy, or inadequacy, of material. Let us now illustrate the effects of inadequacy, and test how far the

mortality in the age-group 20-, and in the other age-groups also, is related to the general level of mortality in the occupation. My first simple illustration was worked out several years ago for lecture purposes. Table B of the Report conveniently summarizes for every occupation the ratio of mortality in each age-group to that of the Standard Population taken as 100, and also gives the C.M.F., divided by 10 to make it comparable with these percentage figures. If mortality were at the same relative level, in any one occupation, throughout life, all these figures would be identical. Actually, whether owing to the chances of sampling or to real variations of relative mortality, they are by no means identical. Considering any one age-group by itself, we can get a good idea of the scatter by working out the percentage ratios for all occupations,

$$\frac{\text{Ratio for age-group}}{\text{C.M.F. ratio}} \times 100$$

and booking up the frequency distribution. This has been done in Table XXII, confining ourselves again to the 164 principal occupations only. It will be seen that the figures for the age-group 20- show an enormous scatter, the above ratios ranging all the way from zero to over 230, with a standard deviation of 39.4. In the age-group 25- the distribution is much less scattered, the standard deviation dropping to little more than half the former value, or 20.0. In the age-group 35- the standard deviation further falls to 14.4. But it is in the two groups 35-45 and 45-55 that the scatter attains its marked minimum, the standard deviations being close to 10 units only and the bulk of the ratios lying between the limits 85 to 115. That these age-groups would show the least scatter might perhaps have been expected from the fact that their mortality-ratios enter into the C.M.F. with the highest weights, cf. the weights shown in Section I (p. 8).

The figures for the age-group 65-70 are of special interest, since it forms no part of the basis of the C.M.F. The standard deviation is naturally a good deal higher than those of the two preceding groups—more than double—but it is only a little higher than that of the age-group 25-, and very much less than that of the age-group 20-.

My next illustration is based on Table E of the Report, in which are shown the ranks of all the death-rates in each age-group, for the 178 occupations and sub-groups. These I utilized for working out the rank-correlations between the death-rates at ages and the C.M.F. To do this I slightly modified the figures of the table cited, in which the zero mortalities are given no rank, and equal mortalities are assigned equal rank: whereas for the simple formula to be

TABLE XXII: Table B of the Report for 1921-3 shows the mortality in each age-group, for every occupation as compared with that of the Standard Population of similar age taken as 100. These percentages were then compared with the C.M.F. for ages 20-65 (divided by 10 to reduce it to a base of 100 instead of 1000) taken as 100, and the frequency distributions of these percentage-ratios drawn up for each age-group from 20 to 70. Thus the figure in Table B for l. Farmers, etc., age-group 20-, is 56: the C.M.F. is 674, and the percentage-ratio taken is $5600/674 = 83$.

Percentage Ratio.	Age-group.					
	20-.	25-.	35-.	45-.	55-.	65-70.
0-	5	—	—	—	—	—
5-	—	—	—	—	—	—
10-	—	—	—	—	—	—
15-	—	—	—	—	—	—
20-	2	—	—	—	—	—
25-	—	—	—	—	—	—
30-	—	—	—	—	—	—
35-	1	1	—	—	—	—
40-	3	2	—	—	—	—
45-	2	2	1	—	—	—
50-	3	—	—	—	—	1
55-	2	2	2	—	—	—
60-	2	3	1	—	—	3
65-	8	5	1	—	1	—
70-	5	5	3	2	—	4
75-	10	4	2	—	1	5
80-	12	10	8	6	7	10
85-	4	16	17	12	8	19
90-	14	17	25	29	20	15
95-	8	24	23	30	44	15
100-	16	24	22	39	26	15
105-	7	16	23	28	27	16
110-	13	9	16	5	11	17
115-	6	8	9	6	9	11
120-	6	3	4	3	4	5
125-	5	4	3	4	4	3
130-	4	4	4	—	2	3
135-	5	1	—	—	—	6
140-	5	2	—	—	—	5
145-	2	—	—	—	—	2
150-	2	1	—	—	—	3
155-	—	—	—	—	—	—
160-	2	1	—	—	—	1
165-	3	—	—	—	—	2
170-	—	—	—	—	—	—
175-	1	—	—	—	—	1
180-	1	—	—	—	—	2
185-	—	—	—	—	—	—
190-	2	—	—	—	—	—
195-	—	—	—	—	—	—
200-	—	—	—	—	—	—
205-	—	—	—	—	—	—
210-	1	—	—	—	—	—
215-	—	—	—	—	—	—
220-	—	—	—	—	—	—
225-	1	—	—	—	—	—
230-	—	—	—	—	—	—
235-239	1	—	—	—	—	—
Total	164	164	164	164	164	164
Standard Deviation	39.4	20.0	14.4	9.9	10.8	23.5

applicable ranks must run uniformly from 1 to 178. I adopted the arbitrary procedure of assigning the zero mortalities the ranks 1, 2, 3, etc. in order as they occurred, and similarly I assigned to equal mortalities successive ranks in order as they occurred: it is one of the troubles of rank correlations that one has so often to do something arbitrary for getting over such difficulties. The results are given in col. 2 of Table XXIII, and may be said to give in a briefer form little more than the information afforded by Table XXII. The rank correlation of the death-rate in age-group 20- with the C.M.F. is no more than 0.51, while the age-groups 45- and 55- stand out with correlations of over 0.9.

These correlations are, of course, in part due to the fact that the age-group itself is included in the data for the C.M.F., except in the case of the group 65-70. To throw a little more light on the matter I proceeded to correlate (1) the death-rate in the age-group with (2) the death-rate standardized over the remaining age-groups between the limits 20 and 65, *i.e.* the death-rate in the age-group 20- was correlated with the death-rate standardized over

TABLE XXIII: Rank correlations of death-rates in age-groups with C.M.F. (178 occupations and sub-groups) and true correlations of death-rates in age-groups with the death-rate standardized over the remaining age-groups between 20 and 65 (164 occupations only, excluding sub-groups).

1. Death-rate in Age-group.	2. Rank Correlation with C.M.F.	3. True Correlation with Death-rate standardized over the other Age- groups between 20 and 65.
20-25 	0.51	0.27
25-35 	0.73	0.71
35-45 	0.86	0.88
45-55 	0.94	0.91
55-65 	0.91	0.85
65-70 	0.69	0.62

25-65, the death-rate in the age-group 25- with the death-rate standardized over 20-25 and 35-65, and so on. I worked from the death-rates stated in the detailed tables of the Report, and thought it desirable to omit all sub-groups, so that only the 164 principal occupations were utilized. The point is of some importance, for the inclusion of a sub-group as well as a principal group may amount to little more than weighting the group. In the case of the tin miners, for example, the inclusion in Table E of both 13 and 13a practically weights this rather wild outlier by two. The resulting true—not rank—correlations are given in col. 3 of Table XXIII.

The correlation of the death-rate in age-group 20- with the death-rate standardized over 25-65 has dropped as low as 0.27. The lowness of the figure emphasizes the undesirability of including the group in the basis of the C.M.F.* The highest correlations are now shown by the age-groups 35-45 and 45-55, the age-group 55-65 giving a correlation slightly lower than that given by the age-group 35-45. We are, however, of course influencing the results here by including the age-group 20- in the "rest." Broadly so far the results suggest not only that it was unwise to bring in the age-group 20-, but that it might have been better to exclude 25- as well. The two correlations in the last line of the table only differ in that the second (1) is a true correlation, (2) is based on the 164 occupations, excluding 14 sub-groups. It will be noticed that it is *lower* than the rank correlation.

Finally, in Table XXIV I give the rank correlations of the mortality in each age-group with every other, between the age-

TABLE XXIV: Rank correlations between death-rates in age-groups (178 occupations and sub-groups).

Age-group.	Age-group.					
	20-25.	25-35.	35-45.	45-55.	55-65.	65-70.
20-25	1.00	0.48	0.45	0.39	0.35	0.16
25-35	0.48	1.00	0.69	0.63	0.53	0.37
35-45	0.45	0.69	1.00	0.78	0.70	0.54
45-55	0.39	0.63	0.78	1.00	0.83	0.65
55-65	0.35	0.53	0.70	0.83	1.00	0.76
65-70	0.16	0.37	0.54	0.65	0.76	1.00

limits 20 and 70. Frankly I wish now that I had evaluated the true correlations, for the 164 principal occupations only: but energy has failed me to do more, and these rank correlations must serve. The highest correlation, 0.83, is that for age-groups 45-55 and 55-65: the next highest, 0.78, for age-groups 45-55 and 35-45: the third, rather surprisingly, 0.76 for age-groups 55-65 and 65-70. Fears that the death-rates in this age-group would be very untrustworthy must, I think, be in some degree exaggerated: there are cases of erratic variation, but on the whole the figures must be fairly good or they would not yield so substantial a cor-

* At the same time I am puzzled by the very low value of the figure, which seems almost inconsistently low compared with the rank correlations in the first row of the next table. Possibly in part owing to the inclusion of the additional 14 sub-groups, and in part to the rather erratic character of the distributions and the deviations, the rank correlations do not seem to be very closely related to the true correlations.

relation. The figures again emphasize the importance of the older age-groups as against the younger.

In my opinion then the age-group 20- should be excluded from the C.M.F. first because of the utter inadequacy of the data in 50 per cent. or more of the occupations—we cannot of course draw any absolute line between adequacy and inadequacy—and secondly because of the very low correlation death-rates in this age-group exhibit with the death-rates at the more important higher ages. The lowness of this correlation is, of course, in part due to the inadequacy of the material itself, but is not wholly due to that cause. Mortality at these low ages—in so far as figures are adequate and trustworthy—is, I am inclined to think, as much an indication of the condition of entrants as of the effect of occupation, a point further discussed below. Thirdly, we have to bear in mind the untrustworthiness of the data. To add yet a fourth reason, if this age-group is excluded we at once get rid of the large and meaningless fluctuations it may introduce into the C.M.F., as in the notorious case of the Barristers, and the resulting high values of the standard errors. It will be sufficient to take as an illustration the case mentioned, 137. Barristers. The following is a comparison of the C.M.F.'s and their standard errors including and omitting the age-group 20-.

	Including 20-.		Excluding 20-.	
	C.M.F.	s.e.	C.M.F.	s.e.
C ₁	1,171	178.4	1,081	106.3
C ₂	1,063	96.6	1,058	96.5
C ₃	1,124	136.6	1,063	98.0

By omitting the age-group 20- all the three C.M.F.'s are brought quite close together, and all the standard errors are reduced, the first and third quite heavily. It is true that the s.e. of C₁ remains markedly the highest, but the difference is now modest.

Dr. Stevenson seems to regard such cases as an argument against C₁ and in favour of C₂. To me C₂ is not, to repeat myself once more, a method of standardization at all: and if we are going to use C₁ (or for that matter C₃) this decision should govern the situation and decide all further method. It *implies* the exclusion of any age-group in which the material is inadequate.

If the data for the years round 1931 are calculated on the basis of the *older* Reports, all that will be necessary to facilitate comparison is a recalculation of the C.M.F.'s for 1921-3 on the basis of ages 25-65: the details of the Report will still serve. This is no great

matter. I give in the Appendix such a recalculation of the C.M.F.'s for all occupations and sub-occupations, with the exception of those afforded by the geographical analysis of occupations connected with Coal Mines: those sub-occupations which for some reason are given at the end of the tables in the Report I have entered in their proper position after the principal occupation. The frequency distribution of the percentage differences between the new C.M.F.'s, based on ages 25-65, and the old C.M.F.'s based on ages 20-65 is shown in Table XXV. It will be seen that in many cases these are

TABLE XXV: Frequency distribution of the percentage differences, without regard to sign, between the C.M.F. for ages 20-65 and the C.M.F. for ages 25-65, in the 187 occupations and sub-groups listed in the Appendix.

Difference per cent. on C.M.F., 20-65.				Number of Occupations.
0-0.9 ...	...	...	...	88
1-1.9 ...	...	...	...	40
2-2.9 ...	...	...	...	29
3-3.9 ...	...	...	...	14
4-4.9 ...	...	...	...	5
5-5.9 ...	...	...	...	8
6-6.9 ...	...	...	...	1
7-7.9 ...	...	...	...	2
Total ...	...	...	...	187

fairly considerable. In over half of all the occupations they exceed one per cent. In 16 instances they exceed 4 per cent. Of the 8 occupations exhibiting a difference between 5 and 6 per cent., 5 are accounted for by the occupations (105, 128, 134, 135, 136) with no deaths in the age-group 20-, in all of which the C.M.F. is raised by something close to 5.5 per cent. The other three in this group are 13a, the Tin Miners, where there is only one death in the age-group 20-; 101. Drafters and Brushmakers, with 11 deaths; and 141. Teachers (not music teachers) with 46 deaths. In both the last two cases the result of cutting out the age-group 20- is to lower the C.M.F., mortality in this age-group being exceptionally high; indeed higher than in the following age-group. In the case of the brushmakers no less than 10 of the 11 deaths in this age-group are due to respiratory tuberculosis: in the case of the teachers, 18 out of 46. Reference may be made to Dr. Stevenson's discussion of the effect of early tuberculosis in creating a peak in mortality about this age on pp. lxxxviii, lxxxix of the Report.

The occupation exhibiting a difference of over 6 per cent. is

121. Messengers, hall porters, etc. : the difference is again a decrease, mortality in the age-group 20- being once more swollen by a high tuberculosis death-rate.

The two occupations showing differences of over 7 per cent, are 137. Barristers—our old friends who presented us with one death when only the fraction 0.36 was “expected” on the rates for the S.P.—and 142. Music Teachers. In their case the mortality at

TABLE XXVI: Percentage ratios of mortality to that of the Standard Population in successive age-groups, for the five social classes and certain groups and occupations.

Age-group.	1.	2.	3.	4.	5.
	Social Classes.				
	I.	II.	III.	IV.	V.
20- ...	67	87	99	104	116
25- ...	65	94	95	105	125
35- ...	76	92	92	105	138
45- ...	85	94	93	101	130
55- ...	87	96	98	97	119

Age-group.	6.	7.	8.	9.	10.
	Silica Dust Group.	Non-silica Dust Group.	55. Cotton Strippers and Grinders.	104. Gas Stokers.	9. Coal-mine: making Roads, etc.
20- ...	97	87	63	97	155
25- ...	131	88	69	78	132
35- ...	187	93	90	105	117
45- ...	220	98	149	114	115
55- ...	222	102	186	170	114

Age-group.	11.	12.	13.	14.	15.
	10. Coal-mine: others below ground.	11. Coal-mine: above ground, not superintending.	121. Messengers, Hall Porters, etc.	133. Insurance Agents, Canvassers.	142. Music Teachers.
20- ...	150	149	253	170	249
25- ...	132	133	151	149	144
35- ...	114	125	113	112	117
45- ...	126	112	112	98	91
55- ...	118	112	101	82	90

Age-group.	16.	17.	18.	19.	20.
	1. Farmers, etc.	2. Gardeners, etc.	3. Farm Bailiffs, etc.	4. Woodmen, etc.	5. Agricultural Labourers.
20- ...	56	100	34	127	87
25- ...	75	91	38	80	85
35- ...	70	68	54	74	65
45- ...	66	61	49	75	63
55- ...	67	69	61	58	67

ages 20- is very high, but is based on no more than four deaths : of these two are due to respiratory tuberculosis.

Having now got Comparative Mortality Figures based on a convenient four decades of age, we can also make a very convenient analysis of the relative mortality before and after middle life by stating separate C.M.F.'s for the two age-periods 25-45 and 45-65. These also are shown in the Appendix, and exhibit in some cases almost astonishing differences.

My interest in the changes of relative mortality with age was stimulated by the results brought out, in the paper by Professor Collis and myself already cited, for the two contrasted groups exposed to Silica dust and to Non-silica dust respectively. The ratios of the mortality in successive age-groups to mortality in the S.P. taken as 100, for these two groups, are shown in cols. 6 and 7 of Table XXVI. It will be seen that mortality in the Silica Group actually starts below normal: the number of deaths is only 46, but at all events we can say that mortality is not high. Three of the included occupations—Tin Miners, Sandstone Miners and Quarriers, and Sandstone Masons—represent to a considerable extent semi-rural occupations. In the next age-group, 25-, mortality rises sharply to 31 per cent. above normal: at 35- to 87 per cent. above normal: at 45- to 120 per cent. above normal, and at 55- to 122 per cent. above normal. In the case of the Non-silica Group, to quote our own words, "the population clearly—judging from the consistent run of the figures—started with a marked advantage over the normal population; but some element in the environment, detrimental indeed, but not nearly so detrimental as in the case of the Silica Group, tells more and more against it with advancing age." The initial ratios of 87 and 88 rise to 102 in the age-group 55-. That this increase, or approximation of the ratios to those of the normal population, does not imply any mere general tendency of death-rates to approximate as life advances is shown by the ratios for Agricultural Labourers—a really healthy group in a healthy environment (col. 20 of Table XXVI). A summary comparison may be made by the C.M.F.'s for ages 25-45 and 45-65 given in the Appendix, the figures for the Silica and Non-silica Groups being shown at the end:

	Comparative Mortality Figures.	
	25-45.	45-65.
Silica Dust Group	1,649	2,213
Non-silica Dust Group	908	1,001
5. Agricultural Labourers	730	655

In spite of their very low mortality, the Agricultural Labourers make an even more favourable showing in advanced life than in early adult and middle life. Cotton strippers and grinders (col. 8, Table XXVI) give a run of the ratios more remarkable than that of the Silica Group, the figures rising from 63 and 69 for the first two age-groups (based, it is true, on only 4 and 14 deaths respectively) to 149 and 186 in the last two age-groups (based on 47 and 69 deaths): the C.M.F. for ages 25-45 is 818, for ages 45-65, 1711. Gas-stokers (col. 9, Table XXVI) also show a remarkable rise, their C.M.F.'s being 940 and 1467.

Now I still think we were quite right in arguing that in the particular case of the Silica and Non-silica Groups the rising ratios indicate populations initially no worse than, or with a distinct advantage over, the normal population, but subjected to a detrimental environment—obviously much worse in the case of the first than in the case of the second. We should be right, I think, in putting forward the same argument in the cases of the Cotton strippers and grinders and of the Gas stokers. But should we always be right in such an argument? The matter is by no means clear, and I deliberately bring it forward for discussion.

The ratios for the five Social Classes are given in cols. 1 to 5 of Table XXVI, and their C.M.F.'s at the end of the Appendix. Class I, the limited uppermost class with the lowest mortality, shows ratios rising steadily from age 25: Class II, rather irregular figures, the lowest being that for the age-group 20- and the next lowest that for the age-group 35-: Class III, skilled labour, gives a minimum in the age-group 35-: Class IV shows maxima in the age-groups 25-, 35-: Class V, unskilled labour, gives a maximum in the age-group 35-.

Class I, then, shows just the phenomenon that we are considering. It does not seem probable that there can be many transfers into occupations included in this class of young men brought up in exceptionally favourable environments. Can we interpret the rise of the ratios in the sense that the environment of the occupation is slightly less favourable, compared with the average, after 45 than before, or generally tends to get rather less favourable as age advances? If not, what is the interpretation? It will be noticed, from the C.M.F.'s in the Appendix, that mortality is higher, relatively, in later life in the case of most, though not all, of the professions: this is true for 132. Civil Service officials and clerks, 133. Local Authority officials and clerks, 134. Clergymen (Anglican), 135. Roman Catholic priests, 136. Ministers of other religious bodies, 138. Solicitors, 139. Registered Medical Practitioners, 140. Dentists, 141. Teachers, 143. Civil Engineers, 144. Architects, 145. Authors,

Editors and Journalists; the exceptions in the fifteen occupations 132 to 146 are Barristers, Music Teachers and Artists.

TABLE XXVII: Percentage ratios of the death-rates from (1) Respiratory Tuberculosis (R.T.B.); (2) Accident in sundry occupations to the corresponding death-rates in the standard population.

Age-group.	9. Coal-mine: Persons making Roads, etc.		10. Coal-mine: others below ground.	
	R.T.B.	Accident.	R.T.B.	Accident.
20-	132	303	119	250
25-	97	321	89	385
35-	82	379	93	262
45-	77	342	87	306
55-	72	278	83	325

Age-group.	11. Coal-mine: above ground, not superintending.		121. Messengers, Hall Porters, etc.	
	R.T.B.	Accident.	R.T.B.	Accident.
20-	126	94	259	289
25-	116	136	185	114
35-	95	146	134	54
45-	71	179	120	36
55-	93	130	162	83

Age-group.	130. Insurance Agents: Canvassers.		142. Music Teachers.	
	R.T.B.	Accident.	R.T.B.	Accident.
20-	187	109	323	—
25-	225	30	144	—
35-	158	90	39	159
45-	121	68	14	43
55-	75	18	41	163

Age-group.	2. Gardeners and their Labourers.		4. Woodmen: Labourers in Woods and Forests.	
	R.T.B.	Accident.	R.T.B.	Accident.
20-	119	25	164	308
25-	108	42	84	227
35-	64	33	49	41
45-	46	55	49	153
55-	50	50	65	150

Further, a number of occupations show just the reverse phenomenon, a fall in the ratios of the death-rate to that of the S.P. as age advances. I have tabulated in Table XXVI, cols. 10 to 15, the

ratios for six occupations showing a more or less heavy and continuous fall. What is the explanation here? An examination of the detailed tables in the Report shows that they are all, without exception, occupations with abnormally high mortality from respiratory tuberculosis in early life, compared with that shown in the same occupation in later life. Dr. Stevenson, in the discussion, to which reference has already been made, of those cases in which mortality actually shows a temporary maximum in early life, concludes that deaths from accident may also be important, at least in the earliest years. In Table XXVII will be found the percentage ratios of the death-rates from these two causes to the corresponding death-rates in the S.P. for the six occupations in question, and for two others to which I will come presently. Taking first the three occupations connected with coal-mines, men engaged in making and repairing roads show a tuberculosis ratio dropping continuously from 132 for age-group 20- to 72 for age-group 55-: the ratios for accident death-rates run irregularly, and cannot contribute appreciably to the fall in the ratio from all causes. The group of "other workers below ground" gives a ratio for tuberculosis falling, though not continuously, from 119 to 83: accident figures are again irregular, "Workers above ground, not superintending staff" give a tuberculosis ratio dropping continuously from 126 for age-group 20- to 71 for age-group 45-, and rising again to 93 for age-group 55-: the accident figures show a continuous rise, not a fall. Turning to the other occupations, "Messengers, hall porters, etc.," show a run of the ratios similar to that of the last group, with a maximum of 259 in the age-group 20- and a minimum of 120 in the age-group 45-: in this instance the run of the accident figures is similar, so that accident also contributes to the run of the ratios from all causes of death. For Insurance agents and canvassers the course of the tuberculosis ratios, based on only 5, 4, 6, 6, 2 deaths, is not quite regular, but both the first two age-groups show high figures and the ratio drops to 75 in the oldest age-group; in this case also the accident ratios show a marked drop, but the actual death-rates are low and cannot contribute greatly to the total. The ratios for tuberculosis in the case of Music teachers are remarkable, but are based on only 2, 4, 2, 1, 2 deaths: for accident the deaths are only 0, 0, 2, 1, 4, and so far as they go the ratios rise. Accident then may contribute in some instances, but the uniform factor in all these occupations is early tuberculosis of the respiratory system. That is not to say it is the only factor, for other diseases must also contribute something, but it is apparently the main single factor. In this connection the two rural occupations, Gardeners and Woodmen, that I have included in Table XXVII are of interest. They

are the only two rural occupations included in Table XXVI, cols. 17 and 19, which stand out with high ratios in the age-group 20-. Both show relatively heavy early tuberculosis. In the case of Gardeners the tuberculosis ratio drops from 119 and 108 in the first two age-groups to 46 and 50 in the last two. In the case of Woodmen from 164 in the first age-group to 49, 49, 65 in the last three: the deaths here are only 6, 6, 5, 6, 6.

Dr. Stevenson remarks (Report, 1921-3, p. lxxxviii): "Tuberculosis may account for the excess mortality of the selected occupations at 20-25, either because young men suffering from phthisis select these as suitable for them, or because of special occupational risk of phthisis resulting in early death, or for both reasons." Personally I find it very difficult to believe in an occupational risk of phthisis so severe as to hit and kill young men almost immediately on their starting on that occupation: I find it almost impossible to believe if the tuberculosis death-rates in later life are low, as in occupations 2, 4, 9, 10, 11 and 142. It seems to me much more probable that the death-rates in early adult life are high because of the character of the entrants to the occupation, because of their home environment and their inherited characteristics. The ratio would then tend to fall with advancing years in part (1) because the tubercular would be weeded out by death, and possibly in part or in some instances (*e.g.* gardeners, woodmen), (2) because the occupational environment represented an actual improvement on the initial home environment.

Both in the case of markedly rising ratios and in the case of markedly falling ratios, then, I am inclined to interpret the figures as affected initially mainly by the character of entrants and not by the nature of the occupation, except in so far as this determines the type of man who takes it up. "Some occupations," as Dr. Stevenson wrote in the brief but admirable Introduction to the Report for 1910-12 (p. ii), "may repel, while others attract, the unfit at the age of starting work, and conversely, some occupations may be of necessity recruited from men of supernormal physical condition." But why, if we wish to get figures indicating, as far as may be possible, the comparative healthiness or unhealthiness of different occupations, should we go out of our way to emphasize a distorting factor of this kind? Does not this discussion suggest exactly what the discussion regarding adequacy of material, the distributions of Table XXII and the correlations of Tables XXIII, XXIV suggested, that it is the two age-groups of advanced life, 45-55 and 55-65, which are of prime importance and mortality in these age-groups the best indication of the healthiness or otherwise of the occupation? If so, and I lean to this view, the C.M.F.'s for

ages 45-65 in the Appendix will be a much better measure for our purpose than either the C.M.F.'s of the Report, for ages 20-65, or the C.M.F.'s for the former age limits 25-65. The following is a comparison of the C.M.F.'s over ages 20-65 and 45-65 respectively for the occupations I have taken as representing rising ratios and falling ratios.

						C.M.F.	
						20-65.	45-65.
<i>Rising ratios.</i>							
	Silica Dust Group	...	...	...	...	1,984	2,213
	Non-silica Dust Group	...	...	...	...	967	1,001
55.	Cotton Strippers and Grinders	...	...	...	...	1,396	1,711
104.	Gas Stokers	...	...	...	...	1,289	1,467
<i>Falling ratios</i>							
9.	Coal-mine: making roads, etc.	...	...	...	...	1,191	1,146
10.	Coal-mine: others below ground	...	...	...	...	1,226	1,211
11.	Coal-mine: above ground, not superintending	...	...	...	...	1,183	1,115
121.	Messengers, Hall Porters, etc.	...	...	...	...	1,200	1,057
130.	Insurance Agents, etc.	...	...	...	...	1,039	887
142.	Music Teachers	...	...	...	...	1,096	905
2.	Gardeners, etc.	...	...	...	...	707	655
4.	Woodmen, etc.	...	...	...	...	714	648

I lean to the view, as I say, that the latter figures, which in some cases are considerably different, are the better, but do not wish to be at all dogmatic or over-confident in this conclusion. It may be that by confining ourselves to advanced life we are merely running into another difficulty. To quote the sentences from Dr. Stevenson immediately following the last cited: "Again, it may well be that the more exacting occupations are continuously giving rise to a process of the selective discharge and transfer to other occupations of those persons who have proved unequal to the strain imposed upon them. This is especially likely to occur during the latter years of life; and would, of course, result in the under-statement of the mortality of the more arduous occupations at the expense of over-statement in the case of those in which refuge is taken." Selective discharge should surely mean a falling ratio, and a "refuge occupation" a rising ratio. Dr. Stevenson suggested Railway engine drivers and Motor-car drivers as two occupations possibly affected by selective discharge. The full specification of the first group is (occupation 106) "Locomotive engine drivers, firemen, cleaners (including motor men)" and I am not clear that a group which covers firemen and cleaners as well as engine drivers is necessarily very highly affected by selective discharge. Such as it is, the mortality ratios in the 1921-3 Report run 82, 78, 72, 75, 85, the

ratios falling to the age-group 35- and then rising again, until in the age-groups 65- and 70 upwards they reach 98. There is no clear evidence here, from the figures themselves, of the influence of selective discharge. Railway signalmen (108) form a more homogeneous group, and a group even more liable, one would have thought, to selective discharge. The ratios between 20 and 65 run 39, 51, 54, 56, 77 and in the two age-groups 65- and 70 upwards 92, 99—the figures rising without a break throughout life. For “Drivers of motor vehicles and steam wagons” (113) the ratios from age 20 are 97, 89, 84, 79, 90, 96, 127—falling to the age-group 45- and then rising without a break. What about the other side of the picture, the “refuge occupations”? The group of “General and undefined labourers” (164) is, one would have thought, the principal and typical refuge for those of broken health, wasters and failures. The ratios run from age 20 onwards 139, 150, 155, 148, 135, 128, 138, exhibiting a steady fall from age 35 to age 70. Things do not seem to go at all as one would expect. It is very cantankerous of them.

The matter seems to me complex and difficult. It sometimes helps discussion to jot down all possible hypotheses that occur to one, frivolous or otherwise, with a note or two on their respective difficulties or the facts that they may explain. Here are my jottings.

Rising ratios may be accounted for—

(1) By no reason connected with the occupation itself. If in some occupations the ratio falls for definite reasons (*e.g.* Insurance Agents, Music teachers, Gardeners, etc.) in the remainder on balance the ratio must rise.

(2) By reason of the youths who enter having been brought up in a relatively good home environment and passing into a relatively bad occupational environment, which tells more and more as life advances.

Probable examples, the Silica dust and Non-silica dust groups, etc.

(3) By reason of the stringent *initial* selection of entrants to the occupation.

My idea is this. Suppose the physical condition of a man *qua* resistance to death—the condition that the Medical Officer of an Insurance Company desires to assess—could be given a numerical measure. Such a measure made at, say, age 20 would not be absolutely but only moderately correlated with a similar measure made in later life, say at 45. Hence there would be bound to be regression. If 100 represents “normal,” a group of picked men determined as 150 at age 20 might average only 125 at age 45.

Query: does this account for the puzzling figures in the case

of some of the occupations one would have expected to be affected by selective discharge, seeing that they are certainly subject to stringent selection at entrance also?

(4) By reason of the environment itself becoming relatively more trying (compared with the average environment of the pool of all occupations) as age advances,

I can well imagine this as holding for some of the professions, *e.g.* medicine.

(5) By reason of the inflow into the occupation of the unhealthy, the wasters and the failures from other occupations.

Puzzle: the General Labourers.

Falling ratios may be accounted for—

(1) By no reason connected with the occupation itself. If in some occupations the ratio rises for definite reasons (*e.g.* the dust groups) in the remainder, on balance, the ratio must fall.

(2) By reason of the youths who enter having been brought up in a relatively bad home environment and passing into a relatively good occupational environment, which tells more and more as life advances.

I suspect this of being a contributing cause in such cases as the Gardeners and the Woodmen, and possibly also Insurance Agents and others.

(3) By reason of negative selection of entrants to the occupation—the exact converse of (3) for Rising Ratios and for a similar reason. A group of poor specimens classed as 50 at age 20 might average as high as 75 at age 45.

Is this a countervailing factor in the case of the General Labourers, and a factor tending to emphasize the fall in the case of the occupations that attract weakly entrants, like the “early phthisis” group?

(4) By reason of the environment itself becoming relatively more favourable as age advances.

(5) By reason of stringent selection of those engaged in the occupation *throughout life*, whether by death or by selective discharge.

Selective death-rates are certainly operative, I should imagine, in all the occupations of the “early phthisis” group. As regards selective discharge: puzzle, almost any occupation in which one would expect it to operate, notably railway signalmen: cf. (3) under Rising Ratios.

Here I stop and leave the continuation of the discussion to others.

APPENDIX.

Table, based on the data of the 1921-3 Report, showing for all occupations and sub-groups (except the analysis of Coal-mine workers by the different fields)—

- (1) C.M.F. for ages 20-65, as given in the Report.
- (2) C.M.F. for ages 25-65.
- (3) C.M.F. for ages 25-45.
- (4) C.M.F. for ages 45-65.

together with the numbers of deaths from all causes at ages 25-45 and 45-65 as some guide to the amount of material on which the figures are based.

Occupation.	Deaths at Ages		Comparative Mortality Figures at Ages			
	25-35.	15-25.	15-65.			
			20-65.	25-65.	35-45.	45-65.
All Occupied and Retired Civilian Males	—	—	1,000	1,000	1,000	1,000
1. Farmers and their relatives assisting in the work of the farm	1,375	4,229	674	680	720	663
2. Gardeners and their labourers	797	2,942	707	690	770	655
3. Farm bailiffs and foremen	81	290	526	537	476	563
4. Woodmen and labourers in woods and forests	47	155	714	683	763	648
5. Agricultural labourers, including shepherds	2,000	5,338	688	678	730	635
6. Coal-mine : subordinate superintending staff	235	718	823	831	708	884
7. Coal-mine : hewers and getters	3,702	5,422	938	943	893	964
8. Coal-mine : persons conveying material to the shaft	576	458	1,204	1,205	1,301	1,162
9. Coal-mine : persons making and repairing roads	447	1,279	1,191	1,171	1,227	1,146
10. Coal-mine : other workers below ground	662	1,758	1,226	1,211	1,209	1,211
11. Coal-mine : workers above ground, not superintending staff	709	1,667	1,183	1,165	1,280	1,115
12. Iron ore mine : underground workers, not superintending staff	99	160	954	945	999	922
12a. Iron ore mine : underground workers, not superintending staff, Cumberland and Lancs.	42	70	1,031	1,004	1,021	997
12b. Iron ore mine : underground workers, not superintending staff, Staffs. and N.R. Yorks.	39	58	792	787	888	765
13. Tin and copper miners : not superintending staff	74	144	3,268	3,408	3,760	3,254
13a. Tin and copper mine : underground workers, not superintending staff	68	120	4,335	4,559	4,751	4,475
14. Stone miners and quarriers	173	424	946	938	966	926
14a. Miners and quarriers of igneous rocks (not granite)	16	29	573	561	697	501
14b. Limestone miners and quarriers	65	140	918	892	961	801
14c. Sandstone miners and quarriers	45	148	1,644	1,678	1,678	1,678
15. Slate miners and quarriers	31	133	944	972	819	1,039
16. Cement workers, lime burners, etc.	48	81	717	725	805	690
17. Brick and plain tile makers, moulders, etc. : furnace and crucible pot-makers	46	124	926	948	727	1,045
18. Potters' mill workers : slip-makers : potters	86	284	1,642	1,666	1,302	1,825

Occupation.	Deaths at Ages		Comparative Mortality Figures at Ages			
	25-45.	45-65.				
			20-65.	25-65.	25-45.	45-65.
All Occupied and Retired Civilian Males	—	—	1,000	1,000	1,000	1,000
19. Pottery dippers, glazers, painters, decorators	15	81	1,413	1,426	954	1,632
20. Earthenware, china, etc.; kiln and oven men, and kiln setters and placers	67	168	1,890	1,878	1,523	2,033
21. Brick, tile, etc.; kiln and oven men	33	84	878	890	760	947
22. Other persons engaged in the manufacture of bricks, tiles and pottery	160	352	1,243	1,251	1,250	1,265
23. Skilled glass-house workers	92	173	1,244	1,251	1,230	1,264
23a. Glass blowers and finishers, not machine hands	52	98	1,314	1,330	1,332	1,328
24. Other skilled glass workers	74	161	1,417	1,418	1,299	1,470
25. Chemical workers	220	438	878	884	908	844
26. Makers of paint, oil, soap, grease, etc.	132	263	918	908	906	909
27. Persons engaged in the smelting, rolling and converting of iron and steel...	625	1,168	1,025	1,044	1,053	1,041
27a. Puddlers	24	160	1,250	1,266	831	1,456
28. Metal moulders	559	966	1,137	1,147	1,062	1,184
29. Iron foundry furnace-men and labourers	337	743	1,116	1,113	1,152	1,096
30. Brass foundry furnace-men and labourers	61	102	1,530	1,554	1,889	1,408
31. Smiths and skilled forge workers	735	2,059	951	950	894	975
32. Machine tool workers and metal spinners	917	1,322	904	969	950	977
33. Fitters, tool setters, millwrights and similar occupations	2,333	3,086	932	930	941	925
34. Boiler-makers and platers, and their labourers	373	768	968	968	900	998
35. Brass finishers and turners	117	209	1,293	1,289	1,434	1,225
36. Copper-smiths	38	61	1,087	1,062	1,168	1,015
37. Cutlors	28	90	1,284	1,296	1,423	1,241
38. File-cutters	23	55	1,851	1,896	2,193	1,767
39. Gas-fitters and pipe-fitters	132	216	975	949	938	953
40. Metal grinders	194	366	1,977	2,031	1,610	2,214
40a. Grinders in the cutlery trade	54	150	3,295	3,376	2,837	3,611
41. Metal glazers, polishers, buffers and moppers	117	159	1,443	1,426	1,463	1,409
42. Plumbers	294	602	937	940	867	972

Occupation.	Deaths at Ages		Comparative Mortality Figures at Ages			
	25-35.	15-65.				
			20-65.	25-65.	25-65.	15-65.
All Occupied and Retired Civilian Males	1,000	1,000	1,000	1,000
43. Riveters and their labourers	1,002	1,055	1,172	1,004
44. Tinsmiths and sheet metal workers	1,011	1,010	930	1,045
45. Gold, silver and white metal smiths	961	961	1,004	942
46. Electrical engineers, fitters and wiremen	1,042	1,048	959	1,087
47. Makers of watches, clocks, scientific and electrical instruments	804	707	877	762
48. Skilled lime and tanyard workers, curriers and leather dressers (not finishers)	1,111	1,105	1,292	1,024
49. Skilled leather goods makers	887	852	896	833
50. Wool sorters	1,225	1,204	1,392	1,122
51. Cotton blow-room operatives, skilled	1,516	1,502	1,478	1,512
52. Rag grinders, wool willowers, etc.	1,198	1,154	1,088	1,183
53. Cotton card and frame (not spinning frame) tenters	1,601	1,652	1,528	1,706
54. Wool and worsted card, comb, or frame (not spinning frame) tenters	1,373	1,390	1,442	1,367
55. Cotton strippers and grinders, and card-room jobbers	1,396	1,440	1,818	1,711
56. Cotton spinners and piecers	1,248	1,250	1,007	1,356
57. Wool and worsted spinners and piecers	1,103	1,078	867	1,170
58. Cotton doublers, winders, warpers, beamers, etc.	1,236	1,234	1,119	1,284
59. Wool and worsted doublers, winders, warpers, beamers, etc.	970	951	927	961
60. Cotton weavers	1,048	1,052	824	1,152
60a. Cotton weavers in towns where artificial humidity is used in the majority of the sheds	1,065	1,087	1,028	1,113
60b. Cotton weavers in towns where artificial humidity is not used in the majority of the sheds	834	814	669	878
61. Woollen and worsted weavers	1,082	1,074	1,064	1,079
62. Weavers of other textiles	888	900	826	936
63. Hosiery frame tenters and machine knitters	929	913	799	963
64. Dye mixers and dyers	1,304	1,314	1,327	1,309

Occupation.	Deaths at Ages	Comparative Mortality Figures at Ages			
		15-65.	20-65.	25-65.	25-45.
		25-45.	15-65.	20-65.	25-45.
All Occupied and Retired Civilian Males
65. Scourers (woollen, worsted and hosiery) : calenderers and finishers
66. Cutters of textile goods and clothing (not machine cutters)
67. Tailors : tailors' pressors and machinists
68. Hat formers, plunkers, stiffeners, etc.
69. Boot and shoe makers and repairers (not factory hands)
70. Boot and shoe clickers and cutters
71. Skilled boot and shoe operatives—not clickers or cutters
72. Grain millers
73. Bakers and pastrycooks
74. Brewers of ale, stout and porter
75. Cellarmen
76. Tobacco factory operatives
77. Foremen and overlookers, woodworking
78. Cabinet-makers
79. Carpenters, coach-builders, pattern-makers and similar occupations
80. French polishers
81. Sawyers, wood-turners and machinists
82. Upholsterers, coach trimmers and bedding-makers
83. Paper mill workers
84. Hand compositors
85. Machine compositors
86. Photographers
87. Printing machine minders and assistants : machine rulers
88. Bookbinders and pattern card makers
89. Employers and managers in the building, contracting and decorating trades : clerks of works
90. Foremen and gangers (building and contracting)

Occupation.	Deaths at Ages		Comparative Mortality Figures at Ages			
			25-65.	25-65.	25-65.	45-65.
	25-65.	45-65.	25-65.	25-65.	25-65.	45-65.
All Occupied and Retired Civilian Males						
91. Bricklayers	1,000	1,000	1,000	1,000
92. Plasterers	854	863	863	900
93. Slaters and tilers	1,011	1,024	1,024	1,026
94. Masons, stone cutters and dressers	1,037	1,016	1,016	1,125
94a. Limestone masons, cutters and dressers	1,390	1,416	1,416	1,502
94b. Sandstone masons, cutters and dressers	1,197	1,233	1,233	1,250
95. Slate masons and slate workers	2,068	2,167	2,167	2,507
96. Platelayers	1,596	1,646	1,646	1,693
97. Contractors' labourers, navvies	920	920	920	942
98. Painters and decorators	910	918	918	879
99. Building trade labourers	1,074	1,079	1,079	1,103
100. Rubber workers	1,060	1,070	1,070	1,100
101. Drafters and brushmakers	892	886	886	908
102. Shipwrights	32	89	1,250	1,212
103. Shipyard labourers	98	934	929	926
104. Gas stokers	175	308	1,351	1,242
105. Railway officials, stationmasters, etc.	94	330	1,307	1,467
106. Locomotive engine drivers, firemen, cleaners, etc.	69	593	717	754
107. Railway guards	448	886	792	743
108. Railway signalmen	141	403	770	811
109. Shunters, pointsmen and level crossing men	119	387	622	603
110. Railway porters and lamp-men	211	204	914	906
111. Livery stable and motor garage proprietors and managers : haulage contractors	596	895	1,027	1,025
112. Drivers of horse-drawn vehicles	237	651	791	788
113. Drivers of motor vehicles and steam waggon	1,777	4,336	1,378	1,385
114. Tram drivers	1,267	871	862	855
	191	173	875	825

Occupation.	Deaths at Ages		Comparative Mortality Figures at Ages			
	25-45.	45-65.	20-35.	25-35.	25-45.	45-65.
All Occupied and Retired Civilian Males
115. Omnibus and tram conductors
116. Grooms and horsekeepers
117. Fargemen and boatmen
118. Stevedores
119. Coal-boat loaders and dischargers
120. Other dock labourers
121. Messengers, hall porters, lift attendants, etc.
122. Porters
123. Proprietors and managers of wholesale or retail dealing businesses
123a. Proprietors and managers of businesses for the sale of fish, meat, green-grocery and milk
123b. Proprietors and managers of businesses for the sale of grocery and provisions
123c. Proprietors and managers of businesses for the sale of textiles and clothing
124. Salesmen and shop assistants
124a. Salesmen and shop assistants in businesses for the sale of fish, meat, green-grocery and milk
124b. Salesmen and shop assistants in businesses for the sale of grocery and provisions
124c. Salesmen and shop assistants in businesses for the sale of textiles and clothing
125. Commercial travellers
126. Canvassers, roundsmen and van salesmen
127. Costermongers, hawkers and street sellers
128. Bank officials
129. Insurance officials
130. Insurance agents and canvassers

Occupation.	Death at Ages		Comparative Mortality Figures at Ages			
	25-45.	45-65.				
			20-25.	25-35.	35-45.	45-65.
All Occupied and Retired Civilian Males	...	...	1,000	1,000	1,000	1,000
131. Auctioneers, appraisers, valuers	...	...	1,031	1,000	902	1,042
132. Civil Service officials and clerks	90	369	739	746	691	770
133. Local authority officials and clerks	664	1,271	776	781	706	813
134. Clergymen (Anglican Church) ...	293	806	561	592	570	601
135. Roman Catholic priests: monks	71	396	780	823	710	873
136. Ministers of other religious bodies	17	58	639	675	531	738
137. Barristers ...	38	197	1,171	1,081	1,183	1,036
138. Solicitors ...	24	94	899	910	732	988
139. Registered medical practitioners	76	436	1,021	999	899	1,043
140. Dentists ...	142	680	910	926	840	964
141. Teachers (not music teachers) ...	71	127	736	699	675	709
142. Music teachers ...	397	1,004	1,20	1,017	1,275	905
143. Civil engineers and surveyors	36	120	1,096	752	743	693
144. Architects ...	101	279	929	907	727	986
145. Authors, editors, journalists	57	182	1,003	1,023	792	1,124
146. Artists ...	64	255	1,005	1,019	1,023	1,018
147. Proprietors and managers of theatres, entertainments, sports, etc.	52	180	1,020	1,039	1,088	1,017
148. Actors ...	99	186	1,336	1,373	1,436	1,345
149. Musicians ...	106	135	1,220	1,211	1,294	1,175
150. Domestic servants (indoor) ...	163	294	885	882	915	807
151. Gamekeepers ...	317	686	667	675	856	596
152. Inn, hotel-keepers: publicans	50	128	1,585	1,637	1,762	1,582
153. Barmen ...	808	3,243	1,955	1,980	2,173	1,896
154. Waiters ...	280	335	1,323	1,321	1,156	1,392
155. Laundry workers ...	120	232	893	895	969	863
156. Hair dressers ...	56	141	1,231	1,231	1,191	1,248
157. Chimney sweeps ...	310	558	1,123	1,071	980	1,110
	27	155				

Occupation.		Death at Ages		Comparative Mortality Figures at Ages			
		25-45.	45-65.	20-65.	25-65.	25-45.	45-65.
All Occupied and Retired Civilian Males		—	—	1,000	1,000	1,000	1,000
158.	Clerks (not Civil Service or local authority) : typists	3,501	5,033	1,019	1,022	1,050	1,010
158a.	Bank and insurance clerks	321	375	937	936	783	1,032
158b.	Railway clerks	421	616	920	922	886	937
159.	Draughtsmen	164	126	894	902	934	889
160.	Warehousemen	648	1,528	1,007	1,000	1,009	996
160a.	Warehousemen—textiles and clothing	116	269	1,421	1,386	1,399	1,381
160b.	Warehousemen—cereals, provisions, and dry goods	70	177	1,039	1,031	1,014	1,039
161.	Storekeepers	281	592	952	945	1,028	908
162.	Packers	343	688	1,097	1,095	1,124	1,082
163.	Stationary engine and crane drivers	528	1,352	937	927	883	947
164.	General and undefined labourers	6,725	17,776	1,438	1,441	1,529	1,403
Social Class		1,207	4,441	812	820	717	865
"	I	14,462	38,590	942	946	929	953
"	II	32,446	65,152	951	948	934	955
"	III	15,837	34,394	1,007	1,005	1,049	985
"	IV	12,654	33,041	1,268	1,264	1,326	1,237
"	V	559	1,530	1,984	2,042	1,649	2,213
Silica Dust Group		248	645	967	973	908	1,001
Non-silica Dust Group		...	...	...	...	...	...

DISCUSSION ON MR. YULE'S PAPER

PROFESSOR GREENWOOD: I think it is unnecessary for me to say that the summary of the paper to which we have listened is from the first to the last word a model of enlightened common-sense; that is only another way of saying that Mr. Yule is its author; no statistician has a more highly developed sense of proportion than Mr. Yule. Those who have been fortunate enough to be his pupils and friends have been frequently saved from faults of over-emphasizing or under-emphasizing the importance of statistical methods.

In the first section of his paper Mr. Yule defines the limitations of processes of so-called standardization, and I think it is important to bear those limitations in mind, because some of the mistakes and ambiguities to which he has drawn attention do arise from neglect of the fact that a pint pot cannot contain more than a pint. The numerical statistical method, as distinct from the tabular statistical method of our ancestors, has been introduced precisely because the power of the human mind to grasp a number of particulars is limited, and the earliest, and perhaps one of the most distinguished intellectual students of this very question—the influence of environment upon health—Hippocrates, tried to reach conclusions by a detailed consideration of all the possibly relevant factors. It was not until the seventeenth century that it was realized that in seeking to grasp everything, one tended to grasp nothing. Then we had the introduction to a statistical tabulation in which our predecessors a hundred years ago were engaged, and we merged individuals into groups, deliberately sacrificing some valuable information for the sake of retaining a clearer view of other important facts. What has happened is that the groups themselves and the information relating to those groups have become more and more detailed, and so we reached the stage when it was necessary to summarize the summaries, and that is at the base of these various methods. In the discussion on Life Tables some years ago we traversed part of this ground, and it was pointed out that no mathematical ingenuity could distil into one or two parameters all the information conveyed by rates of mortalities at different ages. The same remark applies with equal force to the various constants proposed to be used in the summarizing of the rates of mortality now under discussion.

A popular objection to the method discussed on p. 15 and the following pages might be founded on a reluctance to admit these limitations. As was pointed out here eleven years ago, the use of the phrase "Expectation of Life," meaning a certain arithmetical average, had an unfortunate effect upon the public, because the average did not mean what they thought it meant. The notion of a standardized death-rate as an end in itself is unfortunate, and it is not always realized that what we are really concerned with is an index method of rendering groups comparable. I have often pointed out to my students that a summation of the rates of mortality at single years of life would be a perfectly reasonable standardized death-rate (without, however, having realized the advantages which

Mr. Yule has indicated); but that, if it were used, then one would find that some Urban District Councillor would ask what was the standard population, and if he were told that it was one in which there were equal numbers in every age group, he would say there could be no such thing.

Actually the standard population used in the direct method is a fiction, but it is an approximation to what has been a "real" population. If we could only persuade people that the whole process of standardization was *merely* to facilitate comparison, the psychological difficulty created by a choice of a wholly fictitious standard population would vanish.

In ordinary practice, when dealing with large groups, the different methods do not lead to very different results. Mr. Yule has illustrated that very richly. An illustration that Professor Collis and I gave some years ago in our text-book on Industrial Hygiene recurs to me; we compared the occupied males in the industrial districts and in the agricultural districts as recorded in the 1900-2 decennial supplement. If "All Males" were used as the fixed population the two death-rates were:

17.39 per thousand and
12.34 per thousand.

If one used the so-called Indirect Method,

17.39 became 17.49 and
12.34 ,, 12.36.

If one then took a population widely different from the age distribution of all males, viz. a Life Table population at ages 15 and upwards, then

17.39 became 25.46 and
12.34 ,, 18.62,

and by using the Index Method the figures became 25.62 and 18.10 respectively.

Those are four different ways of expressing the ratios of those variously standardized deaths.

The percentage ratio of industrial upon agricultural mortality in each case is 140.9, 141.5, 136.7, 141.5. The difference is trivial. Mr. Yule has gone over a much wider field and has pointed out that not only in small occupations, but even in some large occupations, the difference might be of some magnitude. I suppose even then the pragmatist might say that if one attaches great importance to a close comparison, it is better to go behind summarizing figures, and to deal directly with the age groups one by one.

The second section of the paper illustrates Mr. Yule's happy directness. I dare say that some of our younger colleagues will point out that equation 20 is a cutting of the Gordian knot, that the identification of statistical differences with differentials needs some further justification, but there is this extenuating circumstance. When I began to be interested in statistical methods, thirty years

ago—and Mr. Yule began to be interested in these methods some four or five years earlier—the pure mathematicians were a little scornful of statistical processes and did not much care whether we statistical amateurs used rigorous methods or not. Consequently those of us who belong to that generation have been inclined to use methods which would be regarded by the professional mathematician as a little happy-go-lucky. Since those days a number of highly trained mathematicians have become interested in statistical methods and have very greatly improved the technique of statistical processes. But it still is true that a large number of people who are interested in statistical methods are not very profound mathematicians, and therefore it may be permitted to us to use simpler methods, always provided that when it is shown in practice by more rigorous analysis that they are not adequate, we accept a better method.

I am sure Mr. Yule would feel that supposing a great deal turned upon the comparison of two occupational mortalities, then a more rigorous test than that provided by the approximate standard error would be appropriate.

The third section of the paper offers some material for controversy, but, as I have already exceeded my ten minutes, I do not propose to stand between the Society and those so well competent to discuss the subject.

I conclude by proposing that a hearty vote of thanks be given to Mr. Yule for his interesting paper.

DR. PERCY STOCKS: I am glad to support this vote of thanks to Mr. Yule for what is a very fine piece of work. It is customary on these occasions, sometimes out of politeness, to let fall many laudatory phrases before going on to dissect the paper ruthlessly. The result is that if one desires to express with absolute sincerity, as I do now, one's appreciation of a paper, it becomes necessary to resort to superlatives. I hope Mr. Yule will take the wish for the deed. He has certainly rendered a most useful service in producing with such prodigious industry this excellent study. It comes at a very opportune time, and Mr. Yule can feel assured that his work will be very carefully studied. Whatever one's conclusions may be, it will not be possible for those of us particularly interested in the subject to study this paper without much profit in many directions.

Before passing to the essential points of the paper, I would like to point out that although it would appear from Tables I and II that we are now killing off our aged people quicker than we did thirty years ago, the position is not as bad as these figures would suggest. At ages over 75 the comparison is considerably affected by the fact that Mr. Yule has necessarily had to use the provisional rates for the 1931 population built up from the preceding Census.

Mr. Yule suggests that the indirect method, when employed to calculate a standardized death-rate, is not, strictly speaking, a method of standardization at all. So long as we leave it in the form of a ratio of actual to expected deaths, as we do in calculating comparative occupational mortality, it seems to me to suffer no greater dis-

advantage, either theoretical or practical, than the direct method of obtaining such a ratio, provided that we understand clearly that by the indirect method a good or a bad mortality at a given age has a greater importance attached to it in a group of people where that age is well represented than in another group where it is poorly represented,—whereas by the direct method equal importance is attached to a mortality at a given age whether people of that age form 10 or 50 per cent. of the population concerned. Which of these is the more desirable seems to me a matter of opinion.

Whatever theoretical objections there may be to the further step of turning the ratio obtained by the indirect method into a standardized death-rate, it provides a valuable means of reaching a close approximation to the standardized death-rate that would be obtained if we could apply the direct method to the data. Those of us who have taught these methods to students have been accustomed to point out that they lead to identical results when the local rates bear to the standard rates the same proportion at every age, that is, when the ratio $m_{nr} : m_r$ is the same for all values of r . This is the condition mentioned by Mr. Yule, that $\sigma_r = 0$. Two important consequences follow from this with the present trend of rates. The first is that the further we get away in time from the period of our standard rates, the less likely is this condition to be fulfilled, for the death-rates are falling rapidly at the younger ages and not so quickly in the older groups (Table I). This difficulty can be overcome by bringing the standard rates up to date after each Census, and this is the practice in calculating local standardizing factors. The error which arises from loss of constancy of the $m_{nr} : m_r$ ratio with age is thus kept at a minimum. Local causes which affect the constancy of that ratio of course cannot be eliminated, but experience shows that these are rarely of great importance. This seems to me to amount to practically the same thing as Mr. Yule's suggestion for calculating at each Census a new set of standardizing factors by the direct method, and then using them throughout the next decennium. The method in use has, in fact, a number of advantages over that suggestion.

The second point referred to by Mr. Yule is that in using either method with the 1901 population, we are now over-weighting our standard death-rates with the mortality of childhood, for whereas the 1931 Census population contained 24 per cent. of children under 15, we weight their mortality as though they formed 32 per cent. as they did in 1901. Since the greatest decline in mortality has occurred at these ages, this fact is over-represented in the fall of standardized death-rates, and the lack of improvement at the older ages is not sufficiently represented. The effect of this on the rates is not very considerable, however. Mr. Yule asks whether the weighting is not a bit overdone at the early end of life. From the public health standpoint I think we err on the right side by giving a little over-weight to people of those ages, for they respond by falling mortality much more readily to hygienic progress than people at the other end of the scale, and we want our standardized rates to be as sensitive as possible to such improvement as can be brought about. Personally I am not greatly worried, therefore, because the 1901 standard population has

the effect of paying rather disproportionate attention to the mortality rates of early life.

The disadvantages of changing the standard population are too well known to require any comment, and one of the things in favour of Mr. Yule's method of summing the death-rates at successive ages is that, once established, it would deliver us from the quandary of feeling tied to a standard which is no longer suitable. It has other advantages, such as the fact that a series of comparative mortality figures expressed in terms of one base could be turned into another series in terms of another base by merely multiplying by a constant factor. On the other hand, the fact that it is necessary to limit the range of ages at the upper end in an arbitrary way, and the tendency to give over-weight to the mortality of the older people, are, I think, serious disadvantages. I should need more time to study the method carefully before coming to any conclusion about it in my own mind.

With regard to the section on Standard Errors, it will be no small satisfaction to have in the future Mr. Yule's authority for methods of calculation of such standard errors.

I am not quite convinced that Mr. Yule has proved that the data as a whole relating to occupational mortality at ages 20-25 are inherently untrustworthy, though in a few occupations such as some of the professions we are well aware that this is so. He has certainly shown that the numbers of deaths in many occupations are too small to justify placing any reliance upon mortality rates in this age-group, and if we are calculating C_1 the great variability of the rates is a good argument against inclusion of the group in the C.M.F. If, however, we are only concerned with the total recorded deaths over the whole range 20 to 65 years, as in calculating C_2 , and provided we can eliminate sources of real bias, I see less objection to including in that total a small number of deaths belonging to a sub-group of the range, which taken by itself is subject to a large sampling error owing to limitation of the period of observation to only three years. Might we not on similar grounds omit the age-group 10-15 from the calculation of our ordinary standardized death-rates because at that age the numbers of deaths in small towns in a single year are often exceedingly small? In either case what we are seeking for is a single figure which will give as good a general representation as possible of the mortality risk over the entire range of life during which there is exposure to that particular risk. If the risk begins at 20 or before, and if we are satisfied that the recorded deaths at 20-25 are truly comparable with the recorded totals at risk at those ages, it may be argued that the period should not be excluded. I feel, however, that for many reasons the question of the continued inclusion of the group in the C.M.F. needs to be carefully considered, though it is only necessary to compare the third and fourth columns of Mr. Yule's tables at the end of the paper to perceive how slight is the effect of its exclusion except in a few "freak" occupations.

I very cordially second this vote of thanks to Mr. Yule.

MR. DERRICK felt that it was an honour and a privilege to have been invited to take part in a discussion on the day of his formal

initiation to the Society. The paper before the meeting contained a vigorous analysis of the methods of the General Register Office, and it was not unreasonable, therefore, to give that Office an opportunity of commenting on and challenging, if necessary, those criticisms, and as Dr. Stevenson unfortunately was no longer with us, it fell to Dr. Stocks with his technical experience, and to him with a longer internal knowledge of the Department, to express their reactions to the suggestions now made. He would endeavour to deal as briefly as possible with each of the three sections of the paper, taking them in the order 2, 3, 1.

For the second part of the paper, that dealing with the standard errors of the comparative factors, Mr. Derrick had nothing but gratitude to the author. He supposed that all who had had occasion to use these indexes had been accustomed to make large mental reservations in respect of their probable errors, and had regarded them as general guide-posts rather than as precise comparisons. Mr. Yule had put numerical limits to the somewhat vague reservations, and it was clear from the exceedingly useful comparisons set out in Table XIII that whatever method were used, the errors were on the whole very considerable. The main inference he felt disposed to draw from the table was that the base of 1000 was unnecessarily large, and that it would be better to adopt unity as the standard of comparison and show the C.M.F.'s in decimals, as it would then be possible to vary the length of the decimal to the order of significance of the factor, whereas with the 1000 as a base it was necessary to show three or four figures in every case, notwithstanding that the integer in the unit position was almost always worthless.

One other feature he would like to note in passing was that of the three systems of standardization compared, No. 2, or the Indirect method, involved the smallest error in a large majority of the experiences, and that he regarded as important.

Passing to Section 3, of the experience dealing with the advisability of including the age period 20-25 in the Occupational experiences, he would say, quite frankly, that the question had not been explored in the exhaustive way with which they were now favoured. But though it was not subjected to any scientific test, it was not a haphazard innovation. It was thought advisable to be prepared for considerable changes in industry under post-war conditions; it was felt that recent development in electrical undertakings, motor transport, etc. might be creating new occupations in which the majority of the workers would be young, and that important sections of some of the experience might be sacrificed if the 20-25 age-group were omitted. Further, continuity with the past was already broken by numerous changes in the occupation classification, so that there would be little loss on this account. Still, if they had had the advantage of Mr. Yule's present analysis, it was just possible that the result might have been different.

In regard to Mr. Yule's interesting analysis of the standard errors, he would like to ask whether the largeness of the standard errors in the 20-25 group was really significant—did it of itself worsen the C.M.F. of the occupation as a whole? The group was relatively insignificant

in relation to the remainder in any case, but since it extended the experience did it not, as a rule, tend to reduce the standard error in the total C.M.F.? Again, was the rank correlation, or absence of correlation, between the age-groups of great significance? Diseases of the young were different from diseases of old age, and it was not altogether surprising, therefore, to find occupation groups behaving differently at different parts of the age field. At present the experiences were subdivided in order to examine separate disease incidence, so that there would seem to be some justification on this account for expressly including the young for the purpose of bringing into the picture any special features of their peculiar diseases. The fact that the occupational relationship was one of association rather than one of causation was, he thought, irrelevant, for if there was one lesson that had been learnt from past experiences it was that pure occupational features were inextricably intermingled with social or economic influences in all age-groups. The objective ought surely to be primarily to arrange the data so as to show the association of occupation and mortality and only as a secondary matter to consider whether the relationship was a causal one. There was also the administrative aspect referred to by Dr. Stocks. The importance of identifying one death at 20 might be many times as great as a similar one at 65, for the one ought not to have occurred, whereas at 65 we were approaching the region of inevitability.

The pros and cons of this particular controversy would obviously require careful consideration, and there could be no doubt that Mr. Yule's masterly analysis would be of material aid to those whose duty it would be to decide the grouping to be adopted in future reports.

Coming now to the first and, to him, the most important section of the paper, dealing with the objects and methods of standardization, Mr. Derrick regretted that he found himself in almost complete disagreement with Mr. Yule. He would endeavour as well as he could to refer to the main features which to his mind dominated the situation. Mr. Yule first subjected the methods of the General Register Office to a detailed analysis, and appeared to find the "Direct" method passable, but the "Indirect" method so fundamentally unsound that it was only "thanks to the mercy of Providence that it was not grossly misleading"; he then went on to propose an alternative treatment of his own. Mr. Derrick would like to suggest, and he did so with very great diffidence, that Mr. Yule, in company with other users of these statistics, had mistaken the objective of the standardization procedure. He appeared to have assumed that the object was to produce standardizing factors which, in an integral form, compared the age mortalities in a selected experience with the corresponding age mortalities of a standard experience. Mr. Derrick suggested that the procedure did no such thing.

Under the "Indirect" method, as Mr. Yule himself pointed out, it was not necessary to know the age mortalities of the selected experience! How could the method, therefore, be regarded as attempting to average or compare them?

By the "Direct" method the lapse was even more marked, for they did as a matter of fact apply the selected age mortalities to the 1901 population of England and Wales, but though the age mortalities of the 1901 experience were known, no use whatever was made of them, so that whatever was done, the age mortality rates were not compared. What then was being done? The answer seemed to be reasonably clear. The mortality experience might be thought of as expressing the mutual relationships of three functions; (1) the population exposed to risk, (2) a force called mortality, which operated on the populations, and (3) the product, which was the number of deaths.

While Mr. Yule contemplated the standardization of the mortality factor, the methods in actual use standardized the deaths—simply the number of deaths. Mr. Yule would standardize the operator; current methods standardize the product. Of course, in order to bring a series of experiences into relationship with one another it was necessary to eliminate differences of mere magnitude, and accordingly these deaths were expressed in terms of a common unit of population (1000). This had led to misunderstanding, and he was afraid that this misunderstanding had been furthered by retaining the rate form in the comparative indexes. He fully agreed with Mr. Yule that it would be preferable to use indexes related to a conventional base of unity or 1000, and he had on more than one occasion in the past argued this proposition with Dr. Stevenson, who, however, preferred to think in terms of death-rates. Dr. Stevenson was a master of his subject and it really did not matter what base was used provided that those who used it knew what they were doing.

Whether it was right to standardize the product rather than the factor was another matter and might be controversial. He could quite understand that the statisticians' interest might be concentrated on the factor—the mortality force. But there were practical aspects of the question involved as well. Deaths were realities—the mortality force was an abstraction. To put one aspect of the case very crudely, he wanted in effect to be able to say to a local Medical Officer of Health—"You have returned us 50 deaths; you ought only to have had 40. Examine the diseases involved and the nature of your population and let us know your views regarding the excess."

For this reason, if the Registrar-General canvassed opinions as to whether the objective should be altered in the direction now suggested, Mr. Derrick's present feeling was, as far as his own opinion went, that it would be preferable to stick to the present practice.

If, then, the object in the past had been the standardization of the product and not the factor, the methods employed must be criticized from that standpoint. There were a series of experiences to compare, the deaths in each case being the product of two factors—(1) the population factor, distinguished by its age incidence rather than its total magnitude, and (2) the mortality force, and each of these factors varied as between the several experiences. The two variables could not be accommodated in a single index, and one accordingly had to be eliminated. By the "Direct" method the population variable was eliminated, and by the "Indirect" method

the mortality force variable; so far as principle was concerned, the two methods were precisely similar and any validity test applied to one applied equally to the other. The only consideration that need be regarded in choosing between them was, he suggested, to choose the method that was likely to do less violence to the comparisons—*i.e.*, to eliminate the factor which varied less in the experiences to be compared.

He thought that he could say from his experience that in respect of large experiences generally, such as those of England and Wales as a whole, or large regions, the differences in the behaviour of the two factors were rarely sufficient to make any significant difference at all between the standards produced by the two methods. Each could be relied upon to produce tolerably good results. But when one came to small experiences—and it must be remembered that thousands of experiences were standardized—2000 areal divisions of the country had to be dealt with, the national population had similarly to be divided into some 600 occupation groups, any of which might require separate treatment, and it might be necessary further to subdivide these thousands of experiences according to individual diseases—in the case of small experiences like these, he thought that it would be found that, on the whole, the population factor was the greater variable, and that the most reliable comparisons were those produced by eliminating the mortality variable by means of the so-called “Indirect” method. His conclusion was illustrated by the comparison of the standard errors under the two methods given by Mr. Yule in Table XIII: it was supported by the fact that it dealt satisfactorily with freak age conditions, such as those referred to in the case of barristers, and it had a very great administrative advantage in that it could be utilized without any knowledge of the age mortality rates in the several populations.

Mr. Derrick said he had not discussed Mr. Yule's proposed method partly because he had already overstepped his time, but mainly because it was not, in his view, a substitute or alternative to the present methods used. Its application was remarkably simple, but it was obviously subject to important limitations which suggested to his mind that it might be much more suitable for use in a laboratory than in a statistical mass-production factory such as the General Register Office. At all events, he would prefer to reserve a more complete examination until he knew whether the conception underlying their own treatment was to be altered in favour of the author's view.

Whether he were right or wrong in the views he put forward, he had to thank Mr. Yule for a paper which had given him several hours' stimulating thought: it had certainly shed a great deal of light upon the subject, and for this he was sure that his departmental colleagues would be extremely grateful.

DR. ISSERLIS was surprised to hear that the paper belonged peculiarly to one section of the audience, and he felt moved to ask one simple question. Very often those who were not specialists in these matters wanted to know, for instance, whether the barrister's

occupation had a higher mortality than that of the hewer. From the data available he would like to ask Mr. Yule whether it was reasonable and practicable to compare his population U with the population V directly without introducing a standard population S, and also, when such methods were used, whether it should be done by calculating the mortality of hewers on the understanding that the population distribution was that of barristers, or the other way? He wanted to feel clearer on the matter; if one calculation said that the mortality of barristers was double that of hewers, he wanted to know that by doing the calculation backwards he would find the mortality of hewers to be half that of barristers? He had been rather afraid on looking at the collections of formulæ that he might sometimes discover that the comparative mortalities would not necessarily be the reciprocals of each other, and if he could avoid that by not using a standard population he would like to be directed to methods in which these results would not happen.

The following comment was received after the meeting from Mr. DUDLEY WALTON :—

This is one of those contributions to the higher statistics which is of incalculable value to the few and of infinite bewilderment to the many. It is perhaps characteristic of the cloistered student that he avoids the banality of words of one syllable or the method of journalistic elucidation. Here, in effect, is a dramatic situation which a Euripides might work out with *pathos*, *agon*, and *apotheosis*: the suffering Registrar-General, the struggle of Civil Servitude, and the ultimately bulging coffers of the Insurance Companies. The drama opens with a gifted mathematical don, quixotically emerging after six years' preparation, to tilt at the official windmills. One gathers that the Registrar-General does not understand his own mortality tables, or at least does not compile them in the one best way, if one best way there be. Indeed, the orthodox concept of standardization hardly deserves the name at all. One anticipates a vigorous *dementi* from Somerset House.

A point to note is that nature refuses to be standardized. Evolution, emergent or fortuitous, postulates a changing universe in which no values can be finally fixed. There may not be such a thing as standard mortality, and we cannot yet make an invariable yard-stick to determine its dimensions. The discussion on the standard errors of comparative mortality tables is therefore academic rather than practical. Mr. Yule seems to imply that the whole process is not even pragmatic: that it is only by the favour of the gods the statistics are not grossly misleading. One moral is that actuarial calculations, however precise, must be taken with relatively large factors of safety, and it should help the actuary to have this condition brought to his consciousness. The actuary may thus learn to become a statistician instead of being a mere computer. Mr. Yule's discussion on the age-groups which afford the best indication of occupational mortality is perhaps the most stimulating of his three sections. A determination and analysis of the risks in risky occupations should have far-reaching social and economic results. If

causes of mortality can be isolated, even if they cannot be measured, their effects may be modified. In the printing trade, for example, it has been tentatively found that its recruits are susceptible to certain diseases in early life, while in the alcoholic trades the greater mortality tends to be at the other end. The resistance of individuals to the risk of death is probably as much psychological as physical. Those many minds which are educated to evade reality will often face fantastic danger.

MR. G. UDNY YULE : I am much obliged for the kind things said about the paper. I am not going to attempt to reply, but simply to deal very briefly with one or two of the points that were raised.

Reference has been made to the difficulty of changing the old method of standardization. Honestly I have no desire to change the existing official method of standardization during the remainder of my life. I should prefer the Registrar-General to stick to the old familiar method that I know. I cannot imagine the population of England and Wales of 1901 still being used as standard in 2001 : a change will have to be made some day, but I hope it will not be in my time. The main way in which I thought that possibly my new Method C₃ might be useful was in connection with international standardization, as it eliminates the necessity for a standard population, and I thought it might open up some possibilities in fresh directions of that kind. I put it forward for discussion.

With regard to Dr. Isserlis' remarks, he would not in general get the same result by applying a given method of standardization directly or inversely. My method C₃ has the advantage that the direct and inverse processes are just the reciprocal of each other.

I apologize if my criticisms on the inclusion of the new age-group in the last Report on Occupational Mortality seem severe, but the making of such a fundamental change without giving any adequate published discussion, whatever may have been done in the Office, seemed to me very cavalier treatment of the predecessors of Dr. Stevenson who had all agreed on the limit of age 25.

Mr. Derrick states that our standpoints as regards standardization are very different. Even after having the advantage of reading his remarks in proof, I do not think they appear to be very obviously different. I have, however, only given, in the paper, my own standpoint—the object I want to get at by standardization, and from that standpoint, although by the indirect Method 2, a comparison of a single pair of groups is perfectly good, if you state together all the ratios obtained by a series; the comparison seems to me to be quite illegitimate, and therefore the method does not seem to be a method of standardization at all. I cannot alter that point of view.

With regard to the pragmatic view, namely, what it is best to do, there are many other considerations involved, and I quite recognize that.

I think those are all the points with which I need deal now. I am very glad to have heard the opinions of others, and I hope Mr. Derrick will be allowed to conclude his remarks in the *Journal*.

[Having read the proof of the discussion, I might add a few words further to endeavour to make my own standpoint clear as regards standardization. Any Comparative Mortality Figure purporting to give a ratio of mortalities is clearly an average, for it refers to wide limits of age such as 20-65, or even to the whole of life. If we ask, of what is it the average? the answer is, of the similar mortality-ratios at ages. The fact that we can so arrange the arithmetic that these ratios at ages need not be obtained (cf. Mr. Derrick's remarks) is quite immaterial.]

As a result of the ballot taken during the meeting, the candidates named below were unanimously elected Fellows of the Society :—

Maurice Stevenson Bartlett.	Robert René Kuczynski.
Frederick Tidbury Beer.	Dudley Lemon.
Margaret Anne Bryant.	Archibald Harry Lewis.
William Reginald Buckland.	Eric Mills, B.A., O.B.E.
Edward George Coomes.	Patrick Kevin O'Brien.
Norman William Damerell.	Kennet Pollock, B.Sc.
Robert Spraggon Dixon.	Edward Douglas van Rest, B.A., B.Sc.
Ernest George Frankland.	John Rodgers.
Reginald Arthur Fricker.	Haris Chandra Sinha, M.Sc., Ph.D.
Harry Sutherland Gear.	Edward Somerfield.
Fatehchand Tarachand G'Manie.	Stanley William Sykes.
William Sealy Gosset.	Bernard Howell Wilsdon.
Geoffrey A. N. Hirst.	Frank Yates, B.A.
Thomas William Jones.	

Corporate Representatives :

- Bedford Gater Wallace Attwood, B.Sc., *representing* J. Walter Thompson Company, Limited.
 William Goodsman Barrett, *representing* the United Kingdom Provident Institution.
 Rainald Brightman, *representing* British Dyestuffs Corporation, Limited.
 Alfred George Charles, *representing* the British Metal Corporation, Limited.

THE INTERPRETATION OF THE STATISTICS OF UNEMPLOYMENT.

[Read before the Royal Statistical Society on December 19th, 1933, the PRESIDENT, the RT. HON. LORD MESTON OF AGRA AND DUNOTTAR, K.C.S.L., LL.D., in the Chair.]

By J. A. DALE, C.B.E.

I. THE TURNOVER OF THE LIVE REGISTER.

IT seems to the writer that much of the public discussion about unemployment betrays some misunderstanding of the facts. Many people seem to think of the unemployed as a special class of industrial workers who are surplus to the needs of industry and permanently out of work. There is an excuse for this idea, since the statistics which are best known—the monthly figures of the live register of the unemployed—unless attentively read, lend colour to it. We watch the figures anxiously as they go now up and now down. For many months the total has been about $2\frac{1}{2}$ million or more. Would it pass the 3-million mark, or would the tariffs, the World Economic Conference, or what not, at last lead to an enduring reduction? Seeing that the smallest number for a long time has been over 2,200,000, that surely must be the number of the permanently unemployed.

And even a more careful study of these figures does not bring the facts to light. We find certainly that half a million of the $2\frac{1}{2}$ million are described as “temporarily stopped,” and that nearly 100,000 are persons “normally in casual employment.” But the rest—roughly 2 million—are stated to be “wholly unemployed,” and this is not unnaturally taken to mean that they are unemployed in the fullest sense of the word, wholly and permanently, surplus to industry, a drag on the community.

This is, however, not so. It is true that on the particular Monday in the month when the unemployed are counted, there are in these times about $2\frac{1}{4}$ million of them, but all of them are reckoned as equal whether they have been out of work for a day only or for years. Yet the number who have been out of work for a year or more is under half a million. The rest are unemployed between spells of work of varying lengths, and there is a constant change month by month in the personnel of the unemployed. This fact is well known to the officials of the Employment Exchanges, who call it the “turnover” of the register. At any Exchange the group of unemployed on any day would be made up to a great extent of

different persons from that of a month hence, who would again be replaced by others after another month. There is certainly a block of the unemployed who appear regularly throughout. They are known by the officials as the "hard core." But at all Exchanges, except those in the depressed areas where the Register is "stagnant," they would be but a minority of the total of the unemployed.

Nowadays nearly 6 million different persons claim unemployment benefit or transitional payment in the course of a year. If this is so, obviously the $2\frac{1}{2}$ million cannot be unemployed on every day throughout the year. Otherwise the 6-million figure would be no higher than $2\frac{1}{2}$ million. There are $12\frac{1}{2}$ million insured persons, so that practically every other of them is on the pay-roll of the Employment Exchanges for some period or periods in the course of a year: a fact, be it said, which is deserving of serious reflection. As about half a million are there the whole time, the average duration of the unemployment in the year of the rest must be about four or five months. And these four or five months are not usually continuous but are the sum of the different spells of unemployment in the year.

This "turnover" of the Register can be seen from another fact, namely, that the number of new claims to unemployment benefit or transitional payment is over 900,000 a month. This is true of any month in these times. All of these claims to payment are made by people who have just left employment.

Actually of those unemployed on a particular day, about a million have been on the Register of the unemployed for less than a month and over 1,300,000 for less than three months, while something under half a million have been unemployed for a year or more. Of the 6 million who are unemployed in the course of a year, $5\frac{1}{2}$ have had some work for longer or shorter periods during the year.

Let it be remarked that this classification of the unemployed is true on any day and not simply at one point of time. Again, if 1,300,000 have been at work within the past three months, then the same number—not necessarily all the same persons—will certainly be at work within the next three months. If this were not so, but if all who now come out of work remained unemployed indefinitely, then the total figure would swell rapidly and not remain, as it does, more or less the same.

Although there is no clear dividing line between them, there are thus in reality two different kinds of unemployment. The one is intermittent, the other obstinate and prolonged. The first consists of far more than those who are described as "temporarily stopped" and "casuals." It includes many of the "wholly unemployed." To say that the second consists of under half a million, however,

gives too optimistic a picture. That, as has been said, is the number who have been out of work without a break for a year or more. But a very little work would remove a man from this category, and it would be more accurate to have a figure showing how many people had been out of work for, say, eight or nine months in all in the past year. There would be about a million in the group on that footing, the remaining 5 million being less unfortunate.

It is worth noting that a certain proportion of this 5 million suffer very little from unemployment, and that, if there were no system for the monetary relief of unemployment, their unemployment would not only not be recorded but would hardly be regarded by themselves as unemployment in the popular sense of the word. Some part of the unemployment, for example, in the building trade consists of stoppages due to hard weather and to the inevitable interval between different jobs. If this unemployment is declared and occurs on the day of the count, it is included in the figures. And yet in times past it would have been looked on by the sufferers as an incident of their calling; and it is no doubt because this kind of idleness is unescapable that building trade workers are paid by the hour and not by the week, and at an hourly rate which presupposes that these "off" periods will occur and is therefore higher than the rates in comparable factory occupations, where stoppages due to these causes do not usually happen. The dock workers, too, are dependent on the weather, the frosts and the tides. They are paid by the half-day—again at a rate which allows for this intermittency.

Then there is the "short time" working. On any one day there would be a considerable number of short-time workers recorded as unemployed: at least 200,000 and often more. During a week, however, there would be many other such workers unemployed on one or more days in that week, those only being recorded who happened to be "playing" on the day of the count. Of all of these it can be said that they are not like many of the unemployed who have no wages at all.

At the other extreme there is this million in the "hard core" who really are unemployed in the popular sense of the word, out of work for long periods and many of them "wholly" and "permanently." This is the most tragic part of our unemployment. It is not a homogeneous collection of people, this million. It comprises excellent workers who have had a long and honourable record of employment; but it includes also those who have always had but a precarious foothold in industry. There are many more in proportion in the depressed areas than in the rest of the country, though there are some to be found everywhere. About 100,000 of

them were last employed in the coal-mines. Many of these could and would work again at once if trade improved, but some could not. The shipbuilding centres and the places where the iron and steel industry is carried on contain more than their proportionate share. Again, there is a preponderance of older men among them and of unskilled men, and there are those whom the prolonged unemployment has rendered unfit for work without some considerable help. Far too little is known by the general public about the "hard core," although it is a painful reality to those who have the misfortune to be in it. It is apt to be overlaid by the mere mass of the total figures.

These are the extremes and between them there is unfortunately a good deal of serious unemployment, the duration of which varies widely in the different cases.

This contrast in the quality of unemployment can also be seen from a comparison between two towns of similar size, one of which is a depressed coal-mining town and the other a comparatively prosperous place. At a recent date the registered unemployment in the first was 3700 and in the second 1400, 47 per cent. as compared with 11·3 per cent. But the number of the men who had been out of work for over a year was 2500 in the coal-mining town but no more than 117 in the other. On the other hand, 643 men had been out of work for less than three months in the more prosperous place and only 285 in the coal-mining town. The general suffering is vastly greater in the coal-mining town than in the other.

The "turnover" of the Register is and always has been a feature of unemployment. Five or six years ago, when the Live Register was nearer the million mark, the number of different persons unemployed in a year was $3\frac{1}{2}$ million. The unemployment of a large part of the $3\frac{1}{2}$ million was intermittent. It is the same to-day and unemployment will always exhibit this characteristic as long as each day of unemployment is counted separately.

It may be of some interest to discuss in more detail, first, the intermittent unemployment and then the hard core.

II. INTERMITTENT UNEMPLOYMENT.

Every month there is included in the statistics of unemployment both the number of persons who are described as "temporarily stopped" and also the number of persons unemployed among those who are "normally in casual employment." The "temporarily stopped" are those of the unemployed who expect to return to their previous employment within a period of six weeks. The "casuals" are those who follow an occupation, such as labouring

in the docks, which is from its nature intermittent. They are, of course, very different people from the "casuals" who are otherwise known as the "tramps."

On April 24th, 1933, there were in these groups—

	Men.	Women.
Temporarily stopped	377,000	135,000
Casuals	98,000	1,700
Total	611,700	

The temporarily stopped had all of them been on the Unemployed Register for less than six weeks. If at the end of that time they are not in work, they are reclassified as "wholly unemployed."

The numbers given above comprise those only of the temporarily stopped who happened to be out of work on the day of the count. Not all of them, but a large proportion, are "short-time" workers who, in a brief period of a week or fortnight, are working part of the time and "playing" the rest. The number of persons included in the figures is thus by no means all of those who in any given brief period are working short time, since those who are known to be working on the particular Monday when the figures are taken are not included. The number of persons who are thus temporarily unemployed during a period of a fortnight—that is to say, the "short-time" worker—would be getting on for double those included among the figures of the "temporarily stopped." It is estimated that of the temporarily stopped workers about 150,000 are working short time on a regular and systematic basis, and thus upwards of 300,000 such persons would in any given fortnight be working and playing alternately for approximately equal periods, usually either three days on and three days off, or a week on and a week off.

Of the remaining temporarily stopped workers, many would be working short time, but irregularly and not on any fixed system. Of these, there may be nowadays included in the figures about 150-200,000. This number, too, would have to be more or less doubled to give the number of different persons working under these conditions in a particular fortnight.

The industries in which short time, whether regular or irregular, is most common are cotton and coal. In the cotton industry there were 65,000 "temporarily stopped" shown in the published figures. These probably include about 25,000 persons on regular short time, and this implies that there are nearly as many others in this trade in the same position but not included in the statistics. In the coal-mining industry there were on the day of the count 112,000

workers temporarily stopped. Many of these are working short time irregularly, and there are, of course, others in a somewhat similar position during a fortnight whose unemployment would not be recorded if they happened to be at work on the day of the count.

A large part of the 100,000 "casual" workers also would be working intermittently. Without going into intricate calculations, we may say that at least 150,000 would be the number of different persons in a given week or fortnight who would be in and out of work.

The rest of the "temporarily stopped," apart from those who are thus working and playing alternately, would consist of people who are "stood off" and have an understanding that they are soon going back to work with their previous employer, but who for a period varying from a day to six weeks have so far been disappointed.

In addition to all these, there is in the group of the "wholly unemployed" a considerable number whose unemployment in a short period is no greater than that of many of the temporarily stopped, the reason why they are not included in the temporarily stopped figures being that the Employment Exchange does not happen to know that they have a definite expectation of resuming their previous employment. There are others of the wholly unemployed besides, who, although they have no such expectation when they become unemployed, yet do in fact return quickly to work.

The "temporarily stopped," the "casuals" and the other "intermittent" workers whom we have been considering are, of course, those in those classes during a brief period round about April 24th, 1933. But over a longer period of, say, a year there would be others who had been unemployed in this way but who were fortunately in full work at the end of April, while those who were suffering at that date would in many cases have been more fortunate previously and would be again in the future.

The persons who are intermittently unemployed in the ways just described are obviously to be distinguished from those of the unemployed who have definitely lost their work. They are in receipt of regular wages which are supplemented by the dole for the off days if these are not fewer than the days of work, whereas those who are fully out of work have nothing at all coming in except the dole, and those of them who have been out of work for a long time have often by this time no savings to fall back on. Moreover, the short-time workers have a satisfaction denied to the less fortunate of the unemployed, in that they are attached to an employer from whom they regularly obtain work. They are not entirely cast out; they have at least some work and not none at all; not as much as they would like perhaps, but certainly some.

In a proportion of the cases indeed candour might lead one to

suspect that the work which is available is about as much as is often really desired. The idle time, which is not, of course, usually spent fruitlessly, is not always unwelcome if the income at the end of the week, thanks to the dole, is not very much less than if there had been work throughout. On the other hand, many of the short-time workers undoubtedly are suffering from a lack of work which is unusual in better times and is very far from being welcome now.

It is sometimes thought that there is nowadays a readiness greater than used to be the case on the part of the employer, when he finds the work in sight below the normal, to "stand off" some of his employees. Often a slight shortage of orders leads to large temporary dismissals, even for quite short periods, and in many instances an employer will allow the harassed manager of the Employment Exchange, faced with a sudden and unexpected addition to his charge, to do the work of taking the benefit claims and handing over the money to the claimants on his own premises, there being no room at the Exchange.

This problem of intermittent unemployment is no new thing. It has had to be faced for many years by the Trade Unions who pay out-of-work benefits from their own funds. A study of their methods in this regard, though the circumstances may not be altogether the same, would not be without interest.

III. THE HARD CORE OF UNEMPLOYMENT.

Turning now to the other extreme, namely, the "hard core," as we have called it, of unemployment, let us look first at the available statistics.

A. *Number of Applicants for Transitional Payments.*

The applicants for transitional payments consist of those who have paid less than thirty contributions in the preceding two years, that is, who have worked at an insured trade in less than 30 weeks in that period, and also of those who have been unemployed for more than 26 weeks in a year and have not since had much work. The number of these was, at the dates shown, as follows:—

000's.					
				Men.	Women.
1932	January	...	...	808	98
	April	...	...	930	92
	July	...	...	967	82
	October	...	...	1044	79
1933	January	...	...	1098	77
	April	...	...	1072	76
	June	...	...	1021	66

B. *Number Out of Work for over a Year.*

Each month a figure is published showing how many of those claiming benefit or transitional payments on the day of the count had been unemployed throughout the preceding year. These figures only began to be collected eighteen months ago. Those which have been published are in thousands, as follows :—

000's.					
				Men.	Women.
1932	January	...	...	300	37
	February	...	...	305	35
	March	...	...	315	33
	April	...	...	327	32
	May	...	...	337	31
	June	...	...	353	29
	July	...	...	364	28
	August	...	...	384	28
	September	...	...	403	28
	October	...	...	419	27
	November	...	...	432	27
	December	...	...	436	26
1933	January	...	...	447	25
	February	...	...	452	24
	March	...	...	454	24
	April	...	...	458	24
	May	...	...	460	23
	June	...	...	458	23
	July	...	...	459	21

The men's figure has been steadily increasing. In the first half of the year 1932 it was rising although the Live Register was falling, and the same is happening in 1933, except that there has been a very slight decline since May.

C. *Number Out of Work for more than Nine Months in a Year.*

Another useful figure is one which shows how many of the unemployed who are claiming benefit on a given date had been out of work for, say, nine months or more out of the preceding twelve, all the spells of unemployment in the year being added together. It is estimated that there are just under 1,000,000 men and 70,000 women who have been so unemployed.

These figures give a truer picture than those already set out at B, which show how many have been unemployed for a year or more at a stretch. Quite a small amount of work removes a man from that class, though he may yet be in a desperate plight. This difficulty does not occur in these alternative figures.

D. Number claiming Benefit without the thirty Contributions Qualification.

There is also a set of figures which show how a part, a considerable and an important part, of the "hard core" has developed. Since 1930 it has been known month by month how many persons were drawing unemployment benefit who had paid less than thirty contributions in the last two years, and some similar figures at a few earlier dates are also known. To a great extent these would be persons who had not worked for eighteen months, though they would comprise also some whose last work was more recent but whose previous experience had been unfortunate. It is this group of the lengthily unemployed which has constituted the main problem of Unemployment Insurance.

The actual numbers in thousands at quarterly intervals have been as follows :—

been as follows:

		000's.				
		1929.	1930.	1931.	1932.	1933.
MEN.						
February	... ..	112	131	327	435	638
May	... ..		262	327	468	660
August	... ..		279	374	508	
November	... ..	120	298	423	580	
WOMEN.						
February	.. ...	7	13	79	51	42
May	... ..		45	83	47	41
August	... ..		56	101	45	
November	... ..	10	67	71	44	

These are the principal national statistics about the "hard core." The most noteworthy thing about them, after their absolute volume, is the steady growth since 1930 in the numbers of men who have been out of work for a long time. Before 1930 the figure of those who were claiming benefit without having paid thirty contributions in the last two years was found at the different times at which it was taken to be fairly constant and stood at round about 110-130,000 as far back as 1926.

There were other men in those years who had been unemployed for a long time and were not drawing benefit. Actually on the live register on 21st March, 1927, there were about 90,000 of these, who for the most part signed the register not primarily because they thought that that was the best method of securing work, but because in the few areas where outdoor relief was paid the Poor

Law Guardians made it a condition of payment. How many others there were, both in these Poor Law areas and the rest of the country, we have no means of knowing, as they were not on any public pay-roll, and if, as is likely, some existed, they were not recorded.

In the spring of 1930, however, the figure of those drawing benefit without this contribution qualification rose in the following remarkable way :—

000's.

	Men.	Women.
1930 February	131	13
March	242	42
April	252	43
May	262	45
June	270	52

This sudden increase of nearly 180,000 was not, of course, due to a sudden falling off in trade, since the persons in the group are in it by reason of circumstances which occurred long before. They must for some considerable time before March, 1930, have been unemployed. Otherwise they would still have been in the position of having paid the thirty contributions in the preceding two years. Most of them were not receiving any public money, for the numbers who were paid outdoor relief from the Poor Law fell by a very much smaller amount. The increase was due to the changes in the insurance scheme made by Parliament in the beginning of 1930, the general effect of which was to make it easier to obtain benefit. There had been an agitation against the "genuinely seeking work" condition and against a supposed severity in the administration of Unemployment Insurance, and the change in law and practice had this result. A large part of the new beneficiaries were persons who had been held by the authorities of the Insurance Scheme, namely, the local Courts of Referees and Insurance Officers, to be "not genuinely seeking work" or not to have had a "reasonable amount of insurable employment during the preceding two years." They were now again able to make good a claim to benefit. The abandonment of the first-named condition must, of course, also have increased the number of successful claimants among those who had paid the requisite thirty contributions.

The rise in the figure which began in 1930 has continued steadily, and a corresponding increase can be seen also in the new figures quoted above, which show the number month by month since the beginning of 1932 of those unemployed for over a year.

Little need be said about the figures for the women. Those without the thirty contributions qualification increased in number from

13,000 in February, 1930, to 101,000 in 1931, when, under the pressure of the Anomalies Regulations, there was thereafter a decline. It does not seem that either the increase or the decrease is related in the main to the state of trade but to the current easiness or the reverse of the conditions of unemployment pay.

Some of the reasons for the more recent increase in the "hard core" are unfortunately obvious. The protraction of the trade depression must inevitably add to the "hard core" in the absence of enough new employment.

The rapid increase in mechanization is also sometimes thought to be a factor, at any rate temporarily. Opinions differ as to its ultimate effect. But even on a short view it is hard to estimate the gain and loss. Spectacular instances of displacement of labour are known, and undoubtedly there are plenty of people in the "hard core" who would not have been there but for machines. But if the old processes had continued, would their place in the "hard core" have been taken by others who now find employment not merely on making the new machines, but also as a result of the money saved in all sorts of places by the cheapening of production? But the numbers of these cannot be estimated, nor the persons identified. The time may come when "all we need"—whatever that may be thought to mean—can be done in "half the time," but we are a long way from it yet, and whether we shall ever get there is doubtful, since nothing would stop most people from "working" in the other half of the time.

A further reason for the increase may be due to an "increased appreciation" of the possibilities of obtaining relief. This phrase is taken from the Annual Report of the Ministry of Health for the year 1932, where it is stated to be one reason, among others, for an increase in the numbers of persons in receipt of outdoor relief, and it may possibly have some bearing on the increase in the recorded unemployment in the "hard core."

Again, money is paid out by the Employment Exchanges under easier conditions than used to be the case. The abolition of the "genuinely seeking work" condition in 1930 has already been mentioned, and, moreover, the relation of the benefit payments to the insurance contributions of the individual claimants is not to them a prominent and obvious feature of the scheme.

It seems likely also that since 1930 a considerable number of agricultural workers have acquired a title to unemployment benefit by reason of spells of work in insured trades. The great increase in relief works in 1930 and 1931 must have attracted them by the increased wages which they would earn for the time being. Not only that, but in some rural areas the Local Authority has latterly

made a practice of providing work, such as road-mending, for its uninsured unemployed, and after they have thus acquired a certain number of insurance contributions to their credit, they have been replaced by others and have themselves been able to secure payments under the State scheme. As a class they would not be particularly suitable for many kinds of insured work, and they may be present in considerable numbers among the lengthily unemployed. Of this development, as of others, it can probably be said that "*vires acquirit eundo*."

How much proportionate weight is to be given to these and other explanations of the increase it is hard to say without the most careful enquiries. They must all, however, be borne in mind in making comparisons with the past.

As to the composition of the "hard core," the first thing to note is that this group of the lengthily unemployed is unevenly spread over the country. Very few members of it are found in the more prosperous, very many in the depressed areas. This disparity has existed for years. In 1926, of the 120,000 men drawing benefit without the contribution qualification, 50,000 were in the coal-mining industry. At the present time also this depressed industry accounts for a very large number in the "hard core," its unemployed living in isolated villages where there are few opportunities for work of other kinds. The applicants for outdoor relief were also in those days concentrated in a few areas, three-quarters of them in 1930 being in 34 out of 631 Poor Law Unions in England and Wales. And at the present time wide disparities occur between different areas.

Again, in 1926, 50,000 of the same 120,000 were over fifty years of age, and all subsequent enquiries have shown that the older the age the longer is the unemployment.

The past record of the people in the "hard core" also varies markedly. In December, 1932, of the men in receipt of transitional payments, a group including, and about twice as large as that of, those who had not paid the thirty contributions, 10 per cent. had paid no contributions in 1931, 11.6 per cent. in 1930 and 12 per cent. in 1929. On the other hand, 25 per cent. had paid the full possible number in 1930, 30 per cent. in 1929 and 31 per cent. in 1928, and a further 20 per cent. had paid a very substantial number of contributions in each of these years. This is but another way of saying that the "hard core" consists of those who had done little or no work in recent years as well as of those who had been far more fortunate.

The industrial skill also is variable, but the labouring occupations account for a higher proportion than the rest.

Plenty of statistics could be adduced in support of what has been said, and they all go to show that the "hard core" is spread unevenly over the country, and consists of many diverse elements, and that it is very far from being homogeneous. It is by far the most distressing and intractable part of the unemployment problem.

IV. CONCLUSION.

Prolivity is the enemy of clarity, and though there are many other tempting avenues which might be examined, let it be said briefly in conclusion that an understanding of the facts mentioned above, of the "turnover of the register," of the difference between intermittent and prolonged unemployment, seems indispensable to a proper appreciation both of the unemployment problem itself and of the measures necessary for its relief. The spectacle is not that of a body of industrial workers, two million strong, who are wholly unemployed and surplus to industry. Indeed, if two million workers were suddenly removed from industry, there would be a serious shortage of labour. The spectacle is rather one of six million workers, the half of the insured population, who are unemployed for longer or shorter periods during a year, some of them suffering little and others of them severely. What the remedial measures should be is another story, but one does feel tempted to say two things. The first is that it is just as wrong to assume that the whole of the country is depressed as it is to overlook the special problem of the depressed areas. The second is that, before any large scheme of public relief works is started, it is well to ask how many of the unemployed both could and would work on it. It must be clear from what has been said that it would be a surprisingly small number.

APPENDIX.

NOTE ON THE UNEMPLOYED WHO ARE DEALT WITH BY THE POOR LAW AUTHORITIES.

Beside the figures of unemployment as recorded by the Ministry of Labour, there are also certain statistics produced for England and Wales by the Ministry of Health, and for Scotland by the Department of Health for Scotland, which show the number of persons relieved under the Poor Law. These figures are often quoted in the public discussions about unemployment. They are well over a million, and it is supposed in many quarters—wrongly—that this million has to be added to the Ministry of Labour's figure. What these

Poor Law statistics show is the number of persons in receipt of "outdoor relief," that is, "outdoor" as distinguished from "indoor," which means, broadly, relief inside a Poor Law Institution.

Outdoor relief was until recent years very rarely given where the applicant was able-bodied. Usually if such a person went "on the parish," he was "offered the house," and that not unnaturally acted as a deterrent. Indeed a certain deterrence was an essential feature of poor law relief. Students of the Poor Law will recognize it in the doctrine of "less eligibility." In the depressed areas since about 1921 or 1922 the offer of the house has become palpably impossible, and with the spread of the trade depression there has latterly in other places also come about an extension of outdoor relief.

As recently, however, as 1930, as already remarked, out of 631 Poor Law areas, as they then existed in England and Wales before the abolition of the Poor Law Guardians, there were about 165 in which, on the date of the relevant statistics, no persons were in receipt of outdoor relief on account of unemployment, and another 226 in which the number of men was less than 10. Three-quarters of the recipients were in 39 out of these 631 areas. The present units of administration for which separate figures are available are Counties and County Boroughs (145 as against 631) and there is still a wide disparity between different areas.

In December, 1932, 1,122,000 is given as the number of persons, including dependents, in receipt of outdoor relief from the Local Authorities in England and Wales on one day; or, to be more precise, that is the average number so relieved on each Saturday in December. The corresponding figure for Scotland—the published figure is the actual number on the 15th of December—is about 255,000, making a total for Great Britain of 1,377,000.

These are portentous figures, but some important things must be said about them. First, out of this 1,377,000 about 660,000 were persons not ordinarily engaged in some regular occupation and their dependants. This 660,000 consists of the "permanent poor" relieved on account of old age, sickness, widowhood, etc., and not on account of unemployment. Outdoor relief to this 660,000 is foreign to our present enquiry.

Secondly, the remaining 717,000 includes the dependent wives and children in the households relieved, and these dependants must be subtracted to make the figures comparable with the figures of the Ministry of Labour, either the 2½ million unemployed on a particular day or the 6 million different persons unemployed for longer or shorter periods in the course of a year. The figure analogous to these is about 220,000.

Thirdly, a considerable part of this 220,000 is already included in the figures of the Ministry of Labour. It is generally a condition of outdoor relief that the recipients, if capable of work, shall register their names at an Employment Exchange, and in this way they come to be counted by the Ministry of Labour. In December, 1932, this applied to 159,000 of the 220,000.

Fourthly, of the balance of this 220,000, a figure just above 60,000, not many are unemployed. The Department of Health for Scotland classify persons receiving relief as "able-bodied" unemployed and "other persons." If it can be assumed that the Scottish proportions are to be found in England and Wales, then about 13,000 only of the 60,000 would be "able-bodied" unemployed. The able-bodied persons, excluding dependants, relieved by the Poor Law Authorities thus are the 159,000 registered at an Employment Exchange, plus the 13,000 unemployed not so registered, or 172,000 in all. Even among the able-bodied unemployed in receipt of outdoor relief, sickness may have been the primary cause of relief.

By no means all of the 172,000 are in receipt of any substantial sum from the Poor Law. The Local Authorities often have a scale of relief, allowing so much for the man himself, so much for his wife and an additional sum for each child. Sometimes this scale is higher than the rate of unemployment benefit, either as a whole or for particular combinations of family; and if a person in receipt of unemployment benefit cares to make application, the Local Authority generally makes up the difference. Of the 172,000 able-bodied persons helped by the Poor Law, perhaps 40,000 might be in receipt of small sums on this basis. At any rate it is known that there are 25,000 such cases in England and Wales and doubtless there are some in Scotland. This 25,000 is the actual figure for a certain week in February, 1932. The insurance money or transitional payment received by them amounted to £32,500, while the supplement from the Local Authorities came to under £8,000 or about 6s. 6d. a head on the average. When the 10 per cent. cut in unemployment benefit was made in 1931, not all the Local Authorities made a corresponding alteration in their scales, and hence the number of able-bodied unemployed assisted under the Poor Law by the Local Authorities was greater in 1932 than in 1931.

It is worth noting that this supplementation is not a general practice. In the same week in February, 1932, 87 per cent. of the 25,000 in England and Wales was to be found in 18 out of the 145 counties and county boroughs.

The remainder of the 172,000 would consist partly of persons who were not insured—agricultural labourers and private domestic

servants are not insured—and thus not entitled to unemployment benefit or transitional payments, and partly of insured persons who for some reason had failed to qualify for unemployment benefit or transitional payment but had successfully applied to the Local Authority for relief. All these for the most part would receive a substantial weekly sum according to the local scale.

The total annual cost to the local rates of the outdoor relief of the able-bodied unemployed is for England and Wales about £5 million, and presumably something under £1 million must be added for Scotland. This contrasts with a charge for the same purpose under the national scheme of unemployment insurance and transitional payments of about £118 million a year. Of this about two-thirds comes from the taxpayer and the rest is the insurance contributions paid by the employers and by insured workers in employment.

It is often thought that there is a certain sympathy between these Poor Law figures and those of the Ministry of Labour. If the latter go down, it is said, the former go up. It will be plain from what has been written that no useful comparison can be made between the over-all Poor Law figure of 1,367,000 and the Ministry of Labour figures. Seeing that it is the almost universal practice for the recipients of outdoor relief, that is, the able-bodied adults who are capable of work, to register at the Employment Exchanges, it is obvious that if the Poor Law figures increase in respect of such persons, so also will those of the Ministry of Labour, and that the idea that, if one goes up, the other goes down is plainly wrong.

A variation of this argument is to relate it to Poor Law expenditure. If the insurance administration is "tight," then, it is said, the money so saved is simply transferred to the rates, for the persons whose State money is stopped have to live and have no choice but to go on to the rates. There is more in this argument than the other. In 1930 certain changes were made in the insurance scheme which had the effect of making it easier to obtain benefit, and certainly there was a considerable relief to the rates. The officers of the Local Authorities who administer outdoor relief are very conscious of the relation between the State scheme and their own local outdoor relief, and part of their enquiry into the applications for outdoor relief is closely directed to the question whether the applicant is not after all entitled to benefit, though he may not know it, or whether the authorities of the insurance scheme in refusing benefit really came to a just decision.

But although there is a certain sympathy here, it does not seem that the cost to the rates is increased by exactly the amount saved to the State scheme. On the contrary, it has been found, when

this matter has been enquired into in the past, that, of the persons whose insurance money was stopped, about one in three found some kind of work, about one in six went on the rates, and about four out of five found other means of support, mainly in the form of help from relatives. These facts were ascertained during an enquiry conducted on behalf of the recent Royal Commission on Unemployment Insurance, which confirmed previous similar investigations, and their general credibility is not open to doubt, if due regard is had to the fact that by no means all of those in receipt of insurance benefit are heads of households and to other considerations.

DISCUSSION ON MR. DALE'S PAPER

MR. HENRY CLAY: It gives me great pleasure to move a vote of thanks to Mr. Dale for his paper. I think we should be grateful to him for the economy of figures which he has shown in dealing with a subject in which we are liable to be swamped with figures. At the same time I think we should take this opportunity of expressing our appreciation of the work of the Department which he represents in dealing so scientifically and exhaustively with the statistics of unemployment. Since as a Society we are interested not only in the production of new statistical material, but also in the proper understanding of available material, we should be grateful to him all the more as at this time Parliament is considering the twenty-fourth or twenty-fifth Unemployment Insurance Bill since the war and is engaged in putting the employment scheme on a final basis for the fourth time since 1920.

There can be no doubt that Mr. Dale has selected the most important aspects of the body of statistical material he has discussed, in that he has seized on and exposed the most common fallacy and drawn the right inference from the figures. The most common fallacy is that the unemployable are a standing army of 2 or 2½ million people. The right inference which he has drawn for our benefit is that there is no such standing army or only a very small army. The problem of unemployment resolves itself, therefore, into two elements: (1) an element of intermittent unemployment, the risk of which is widespread, and (2) an element of persistent unemployment, the hard core which calls for different provision from that which will serve to meet the first need. He described this hard core of unemployment as the chief difficulty of the Unemployment Insurance Scheme. It has proved to be that, and it seems to me that the only solution of that difficulty is to exclude from the Insurance Scheme, by some device which must inevitably be more or less arbitrary, the persons suffering from that kind of unemployment, and to make other provision for them. That is the basis of the present Bill before Parliament; the basis, indeed, of the various temporary amendments of the Insurance Scheme that have been

made since the Scheme was first launched. I do not see any way in which it is possible to get away from that distinction.

The material upon which Mr. Dale has drawn, and the inferences which he is able to make, are not all derived from the monthly figures of unemployment which appear in the *Labour Gazette*. Our knowledge of the composition of the unemployed population is derived from other material in the possession of Employment Exchanges, and still more from the material from sample enquiries, the first and second of which were first published in papers read by Professor Hilton before the Society. These make possible an extraordinarily detailed analysis of the composition of the unemployed body, and I think it is worth while supplementing Mr. Dale's paper on one point by quoting the distribution of unemployment as shown by one of the most recent of these sample enquiries. It covered all those persons who had been in insurance for the whole of the period 1923-30 in which the statistical basis of the return was the same, and it showed that of those persons, 35.2 per cent. had drawn no benefit at all; that 38 per cent. had drawn benefit for less than 10 per cent. of the working days in the period, and only 7 per cent. had drawn benefit for more than 30 per cent. That confirms from another angle what Mr. Dale pointed out about the distribution of unemployment, and is an important indication of the risk that is run by the insured population over a period of years.

Having no criticisms or corrections of the paper to offer the Society, I would like to point to one or two other purposes which the published statistics serve, and to confine myself to the statistics published in the monthly *Labour Gazette*. In the first place, it seems to me that the value of the monthly figure as an index of industrial activity or as a measure of unemployment is not affected by the composition of the figure with which Mr. Dale has dealt; it serves as a very representative figure of the changes in the volume of unemployment and also as a measure of the problem of relief with which the country is faced. And in that connection I think more attention might be paid to the whole series of figures since 1920, and less to the extraordinarily high figures of the percentages of unemployed in the last two or three years.

In the scheme of Unemployment Insurance as at present in operation, and as it will be when the Bill before Parliament is passed, it would seem that too much attention is paid to the recent very high figures of unemployment—figures which are surely due to the world depression. I am wholly in favour of making an unemployment scheme "solvent and self-supporting"; but to satisfy that condition, experience should be taken over a period of seven or ten years. The scheme need not be self-supporting in a year like 1932 or 1923, and to base contributions and benefit rates on unemployment at the height of the latter two years seems to me rather like basing a scheme of fire insurance on the basis of the year of the Great Fire. Another point; while the claims to benefit are a good record of unemployment, the contributions are not an equally good record of employment. A contribution cannot represent more than a week's work, but it may represent as little as an hour's work, a single job for an hour or two or

a single day in the week. That is of importance, as the contributions are the only record we have of employment. If the unemployment insurance benefit were strictly based upon contributions, that would not matter, but a right to benefit for twenty-six weeks in each of two years, on the basis of thirty contributions, obviously is not so based. One can only understand the thirty contributions basis of the scheme on the assumption that it is taken as an indication that the insured person has a definite status in industry and can reasonably be expected to get back to work some time. Particularly in industries where casual engagements are possible, this does not follow: half a day's work in each of thirty weeks is no evidence of an assured position in industry, and seems an inadequate qualification for 52 full weeks' benefit.

The second purpose the monthly statistics serve is to show the trend of industrial development; for the Ministry of Labour for its own purposes has classified the insured population in a hundred industrial categories, and revises the numbers in each category every July. The result is that we have a remarkably complete picture of the divergent development of different industries in different parts of the country. Here again, however, there is need of interpretation, because by themselves the figures of the insured population do not always indicate the true development. I can illustrate that by reference to three industries, which were also referred to by Mr. Dale in his paper:—

(1) The Cotton industry. The insured population in this industry did not change from 1923-30; the drop in production between the censuses of production of 1924 and 1930 was 26 per cent. Since then there has been a decline in the numbers returned as belonging to the industry; the 1930 figure was inflated by facilities for getting benefit, to which reference has been made; but these have been stopped, and this year the decline is about 11 per cent.; the number of spindles has, however, been reduced by an eighth, and the number of looms by a quarter, so there is evidently something which has prevented the number of cotton operatives recorded in that industry as representing the real state of affairs in the industry. I do not think there can be any doubt that this illustrates one of the points brought out by Mr. Dale—the reaction of the insurance scheme itself on the number of people in different industries. The scheme encourages the practice of organized short-time working. Organized short-time work has been worked now for thirteen years in Lancashire, and has had the effect of retaining in the industry a number of people who can never hope for full employment in that industry again.

(2) The Building and Public Works group. In the case of building there has been a 30 per cent. increase since 1923, but unemployment has increased at about the same rate as employment. In the case of public works, the number of persons recorded as insured has more than doubled, but of the people recorded in that industry, nearly half were unemployed at the end of October—the last date for which I have figures. It will be seen that this industry illustrates the point so frequently urged by Sir William Beveridge, that, if you

give unemployment relief without any control of recruiting, you run the risk of increasing unemployment at the same rate as increasing industry.

(3) The Dock industry has apparently a normal unemployment percentage of 30—due no doubt to the system of casual employment. This was first demonstrated by Mr. Booth over forty years ago, confirmed by Miss Rathbone early in this century and again confirmed by Sir William Beveridge.

Nevertheless, these figures do give a better figure than any other series we possess of the changes in the development of British industry. Whether when we know the trend we are much better off is another question. One member of this Society, Mr. Brunner, has recently suggested that Government policy in recent years has been, having ascertained the trend, to resist it by lavishing favours on declining industries like coal and railways, and putting up obstructions to expanding industries! That is a problem of the use of statistics, and not of statistics themselves.

In conclusion, we may, I think, claim that on unemployment this country has more complete statistical information than any other country, and I can think of few economic problems in which the statistical information is so complete. We have not as a country made full use of this statistical information, but we should thank Mr. Dale in his own person and as a member of the Department responsible for this extremely complete information, for his paper, and for their services generally.

MR. A. W. FLUX: Unemployment statistics are not among those things to which I have devoted a great deal of attention, but I have a point of contact with them dating back to the investigations that preceded the first Unemployment Insurance Act. When preliminary estimates were required of the contributions appropriate to the benefits proposed, the task of preparing them was assigned to me. The correctness of the forecasts will, to my regret, never be capable of verification, owing to the changes that have been made in the original scheme, but such figures as have been put before us to-night might possibly provide some kind of test of their general soundness. The basis of ascertained fact upon which it was necessary to build at that time was by no means as broad or as solid as could have been desired.

I refer to this matter because it does give me a certain right to say a word about unemployment statistics. The material put before us brings out in many special ways the peculiar nature of the unemployment problem. One thing is suggested in Mr. Dale's paper very definitely—and it is because it is suggested so definitely that I feel inclined to murmur the constant plea of the statistician—the plea of *Oliver Twist*—"Give us more." I think that the point stressed by Mr. Dale—the difference between the situation in different parts of the country—is a point on which some further light might be thrown, by the extension of certain of the classifications in his paper to some of the larger subdivisions of the country. It may, possibly, have been done already in those investigations to which Mr. Clay referred

in his remarks, or it may be that it is in the records of the Employment Exchanges themselves that the necessary data will be found. Mr. Dale stressed the necessity of not losing sight of particular areas when looking at general averages, and not forgetting that the country as a whole is not suffering in the same degree as certain sections of it. In taking the averages for the whole country, and in congratulating ourselves that the problem of persistent unemployment is better measured by some figure between half a million at one extreme and 1 million at the other, than by the $2\frac{1}{2}$ million commonly cited, there may be a danger of losing sight of the local concentrations of unemployment. The figures that would represent the severity of the problem in the very distressed areas might be found to be quite as striking in reference to their conditions as the $2\frac{1}{2}$ million is in reference to the whole country.

If it were possible for the Records Department of the Ministry of Labour to subdivide some of those tables in which Mr. Dale gives us certain warnings of interpretation, the contrast of the very heavily smitten areas in the North and other parts of the country would, I think, be worth expressing in tables of that type, and might concentrate for us in an illuminating way what is contained in the four reports of the Distressed Areas, published some time ago.

I feel inclined to submit to Mr. Dale's judgment the question whether there was another delusion which he had destroyed or whether I am misinterpreting the indications of his paper. I meet, as I go about, people who talk as if the system of unemployment benefit had encouraged a practice on the part of the female insured population which might have been cured if only it were possible to drive unemployed applicants for benefit into domestic work. It seemed to me that the figures given to-night suggested that no very important contribution to the supply of domestic workers could be obtained in that way. That is one of the points where a statistician is apt to find himself in the position of a destroyer of idols.

Mr. Dale referred to the incidence of long-period unemployment on the persons of higher ages—over 50 in particular. There again I felt that I was hungry for more information on the lines on which some other statements are elaborated in the paper, and there again I do not know whether it is possible to give the degree of elaboration that seems desirable. It might be found that there was a great concentration of distress among the older unemployed, and a correspondingly decreased degree of distress at lower ages.

During the visit to the United States which I had the pleasure of making a year ago, I had a number of conversations with persons interested in the problem of Unemployment Insurance in that country. One point of view, expressed very emphatically in certain cases, was that unemployment was an essentially uninsurable risk. That seemed to me to be looking at the problem from a wrong angle. Mr. Clay has told us something of this aspect when he said that the determination of the insurance premium appropriate to a special fire risk should not be based on an experience such as that of London in 1666. The point involved really was that the experience, since special attention has been directed to this problem, was that of a

period of very unusually severe unemployment. The original scheme of unemployment insurance in this country began to accumulate reserves in the early years of its being, and was thus much better placed than the schemes, or the extensions, of later date. Whether the reserves accumulated would have sufficed to meet the heavy demands of the period through which we have since passed is another question. Increased benefits have, naturally, added to the burdens to be carried. Provided we were dealing with a cyclical movement, however, the view that unemployment is essentially an uninsurable risk does not appear to be justified.

(The Vote of Thanks was put to the Meeting and carried unanimously.)

MR. E. C. RAMSBOTTOM said he would like to add his tribute to those already paid to Mr. Dale for his interesting and instructive paper, which had done a great deal to clarify some of the principal statistics of unemployment, and to present them from an aspect which was much less familiar to the general public than to those whose daily work brought them into constant contact with the figures. It was very desirable that this aspect of the subject should be made more familiar to the public, and it was through such agencies as meetings of this Society that this could best be done. He did not suppose that the introductory remarks in Mr. Dale's paper were intended to imply that in the official publications in which the statistics were presented there was any lack of the necessary explanations. The difficulty was that the *Ministry of Labour Gazette* and other official statistical publications were not "best sellers," and the popular impressions of the unemployment statistics were derived mainly from paragraphs in the Press, often merely from headlines. It was well, therefore, that someone with Mr. Dale's practical experience should have this opportunity to get some of the leading facts across to the public.

Mr. Ramsbottom said there were one or two observations he would like to make on various passages of the paper, by way rather of explanatory footnotes than of criticisms.

On p. 86 there was a reference to an average duration of unemployment in the year of about four or five months. The reader should understand that this four or five months' duration related to the six million claimants, and not to the total of twelve million insured persons.

On the same page reference was made to over nine hundred thousand new claims to unemployment benefit every month. Mr. Ramsbottom knew what Mr. Dale meant, but he was a little uneasy as to possible misapprehension by the public. The figure was explained by the next sentence but one, where it was said that all these claims were made by people who had just left employment; there was, however, a possibility that the public might take the words "new claims" to mean that nine hundred thousand persons every month were making claims who had not previously made claims before or during the current year. It should be noted that the nine

hundred thousand included the renewal claims of persons recently out of employment who had now once more become unemployed.

It was also necessary to remember that on the first page of his paper, Mr. Dale had been painting with rather a broad brush, and for that purpose had related figures of insured persons to the total numbers on the register. That was quite valid for the purpose for which the paper had been written, but any student who wished to explore this matter further might find it necessary to make allowance for the differences in the composition of the live register totals, the totals of insured persons unemployed and, on the other hand, of the number of claimants. There were persons on the live register who were neither insured persons nor claimants; although of no practical importance from the point of view of this paper, they might be of importance to those wishing to carry the analysis further.

His only other observation on the paper related to what Mr. Dale had said with regard to short-time workers. He was not quite clear whether some of Mr. Dale's estimates as to the number of short-time workers were not a little too high: it would depend partly on the definition of a "short-time worker." Mr. Dale, in his reply, would probably explain that to a large extent these figures relating to the short-time workers were of the nature of estimates. Certainly the figures for the present time would appear to be smaller than those suggested by the paper, which related to April last. Mr. Ramsbottom hoped that material might shortly be available to enable it to be estimated with greater confidence what was the number of people on short time, or on systematic short time, at a particular moment. While on this subject, he wished to refer to the statement that the industries in which short time was most common were cotton and coal. The statement was true if one was thinking of the industries in which the greatest number of people were on short time, but there were other industries, such as iron and steel, in which the proportions of workers on short time during periods of depression were as great as, or possibly even greater than, in the cotton and coal industries.

Mr. Clay had referred to the special statistics obtained from time to time by means of sample analysis, and had quoted some figures covering a period of seven years up to 1930. Those interested in these figures would find some further information in the results of another sample enquiry, published in the September and October issues of the *Ministry of Labour Gazette*, in which were analysed the proportions of insured persons who had had various spells of unemployment during the year 1932. These figures showed that of all the persons insured throughout the year 1932, over one-half had no unemployment in that year; about 15 per cent. were unemployed for six months or more; about 8 per cent. for nine months or more; less than 3 per cent. were unemployed throughout the whole year, and less than 1 per cent. had been unemployed for two years.

Reference was made by Mr. Clay to the fact that changes in the figures of insured persons in certain industries did not correspond with those shown by the Census of Production between the years 1924 and 1930. This was true if the comparisons were based on the total numbers of insured persons, including those unemployed. In the

December issue of the *Ministry of Labour Gazette*, however, index-numbers were given showing the changes in the numbers of insured persons in employment over the period 1923 to 1933. For the cotton industry the index figures (based on 1923 taken as 100) were, at June of each year :—

1924	.	.	.	.	.	108.9
1930	.	.	.	.	.	75.1
1933	.	.	.	.	.	85.2

Those figures reflected, much better than the total numbers insured, the changes in employment over the period, and would probably be found to be in much closer agreement with the number of spindles and looms in operation, and with the figures of the Census of Production.

One reflection which must be in the minds of many who had listened to the paper was the extraordinary improvement over the past twenty years in the statistics of unemployment. In the days to which Mr. Flux had referred, when estimates had to be made for the purpose of the first Unemployment Insurance Act, the only figures available were the percentages of unemployed among certain Trade Unions, not by any means representative, which had a total of less than one million members. At present there were available statistics covering an insured population of nearly thirteen million, and once a month figures were provided of the numbers of unemployed, classified in over a hundred industrial groups, distinguishing age and sex, groupings, and separating these wholly unemployed from those "temporarily stopped." In addition there were regular statistics showing the length of time the unemployed had been on the register. From time to time sample enquiries were made, the results of which were published, giving further details as to the composition of the unemployed, and as to their circumstances. The contrast must be very gratifying to the Royal Statistical Society and to all those who had been pressing for the improvement of social statistics. It was very largely to those who had been concerned with the actual administration of the legislation with regard to unemployment and unemployment insurance, that this improvement was due, because of the appreciation they had shown of the practical value of good statistics, and of the initiative they had shown in ensuring that sound statistics should be made available. It was to be hoped that some other branches of social statistics might benefit from a wider extension of such appreciation in the future.

MR. C. OSWALD GEORGE said he would like to pay a tribute to the paper and, as one who could lay claim to no special knowledge of the subject, to commend in particular its clarity. Of especial interest was the treatment of the hard core of unemployment, but there was one apparent discrepancy which was rather puzzling.

In the introductory Section I, Mr. Dale said, referring to "a figure showing how many people had been out of work for, say, eight or nine months in all in the past year, there would be at most a million in the group on that footing, the remaining five million being less

unfortunate." But, later on (in Section III, C) he said a "useful figure is one which shows how many of the unemployed who are claiming benefit on a given date had been out of work for, say, nine months or more out of the preceding twelve, all the spells of unemployment in the year being added together. It is estimated that there are just under 1,000,000 men and 70,000 women who have been so unemployed."

It seemed particularly puzzling in that the first estimate related to all persons unemployed for "say, eight or nine months in all in the past year," whereas the second estimate was restricted to persons unemployed for "say, nine months or more out of the preceding twelve," and was further restricted to the number of such persons "on a given date." Yet the second estimate was higher.

In view of the importance of the "hard core," it would be interesting if Mr. Dale would state the basis of his estimate, and he could at the same time no doubt explain the apparent discrepancy in a very simple fashion.

MISS COLLET said she had been reading this paper in conjunction with the November and December numbers of the *Labour Gazette*, and she wished to congratulate her former colleague, Mr. Ramsbottom, upon the wealth of material that he had at his disposal, and still more upon the freedom that he had in using that material properly. If these two numbers of the *Gazette* were read together with Mr. Dale's paper it would be found that there was hardly anything that had not already been said; there was only one matter in which the paper failed in perfection. In order to explain her point, she would refer to statistics with regard to the clothing trades and also to the mining trade. She gathered from the comparative table in the November *Gazette* that during the last year there was an increase of entrants into the mining trades amounting to 2 per cent. of the numbers engaged in the mining trades a year before. She could not imagine that those new entrants could be juveniles who had entered into insurance, as that would mean about 20,000 new people entering the coal-mining industry. In all probability a large proportion of that number returned from agriculture; they would be called "new entrants" because they had not been insured for some time.

Referring to the clothing trade, Miss Collet remembered Mr. Flux's first report in 1907, which brought out the point which could have been guessed beforehand, that the amount of money spent on men's clothing was considerably greater than that spent on women's. If one looked at the comparative figures that had been published in the November *Gazette*, one found that in the expanding trades those of shirts, collars, etc., and also tailoring, had expanded very considerably, whilst in the contracting trades dressmaking and millinery had contracted very greatly. There was no obvious reason why that contrary movement should have happened. This called attention to the fact that there were a large number of people not insured because they worked for private customers on their own account. In the dressmaking trade there must be a vast number of women working for their living who had no means of insurance. These instances

pointed to what appeared to be a defect in the way the statistics had to be presented. It was not the fault of the Ministry of Labour that people were not reminded that there was a considerable movement from the uninsured trades to the insured trades. She did not see why it should not be possible for the different Insurance Departments to give their statistics to the other Departments. If this were done it would be possible to subtract the people in Unemployment Insurance from the total in Health Insurance and see where the insured trades were drawing workers from the uninsured trades. Agriculture and domestic service were not represented at all in the Ministry of Labour Tables of Employment, and people were not reminded of the large number of persons included in those occupations, whereas they needed to be so reminded.

MR. REEDER said there were one or two points with which he would like to deal in connection with the paper, and perhaps to reply to one or two points raised by speakers in subsequent discussion.

Mr. Flux had raised the point about the analysis of long-term unemployment according to age. There were some figures on that basis derived from the last enquiry, which showed that of the men who had been unemployed for over twelve months, nearly one-fourth were men over fifty-five, and nearly 45 per cent. were over forty-five. In the 55-64 group, 40 per cent. had been unemployed continuously for two years or more, so that there was no doubt that the long-term unemployment did consist largely of men who were moving out of the industrial field altogether. There was one point in the paper which referred to the figures, given on p. 92, about the numbers out of work for over a year. Careful students who took the trouble to compare these figures with others in the October issue of the *Ministry of Labour Gazette* would find a discrepancy, for the figure given for November, 1932, on p. 92, was 432,000 men and 27,000 women, whereas in the *Gazette* it was 333,000 men and 17,000 women. The explanation was that the figures given in Mr. Dale's paper, taken from the monthly analyses published in the *Gazette*, were necessarily obtained in the most inexpensive way from the machinery of the Ministry of Labour. This analysis had to be obtained on the basis of the period during which the documents were in the files, and by reason of the fact that if a man worked for three days or less his documents were not necessarily removed from the files, this tended to inflate the monthly figures, whereas the figures derived from the sample enquiry included only those who were actually unemployed on every day in the year. Perhaps, therefore, the figures were not quite so alarming as they appeared to be.

Another point raised by Mr. Flux was with regard to the district figures. The answer was that the figures were available by districts, but the space available for publishing them was very limited, and their production depended upon the public demand for them. Mr. Flux had addressed his request to the right person; there was plenty of material to be published provided there were sufficient space in which to give it.

One or two points had been raised by Miss Collet. With reference

to coal-mining, the new entrants *were* insured juveniles under 18, because entrance into coal-mining for persons over 18 not previously in the industry was forbidden.

On the question of the movement from uninsured to insured trades, some figures had been compiled and published in the *Gazette* for December, 1931, and that was a piece of work of which it was hoped to do more, but the Department was hampered by the pressure of more urgent work, and it probably could only be done at infrequent intervals.

Mr. Reeder said he would like to call attention to the result of the last analyses of the composition of the unemployed. In that enquiry a test had been devised which was based on Employment Exchange daily practice, to find how many of the unemployed were really unemployable. Local Managers were asked how they would classify a man who came before them as an applicant for a local vacancy, without any special features, in his own occupation. (1) Was he suitable on all grounds? (2) Had the man some personal disability such as would make his engagement doubtful? (3) Was he suitable on personal grounds but lacking in industrial experience? (4) Was he unsuitable on all grounds? Some interesting figures were obtained as a result. The men who were classed as unsuitable on all grounds represented about 1 in 30 of the unemployed, but 1 in 6 were apparently subject to disability on personal grounds, such as age, physical condition, health, and physique; 5 per cent. required additional experience, and 75 per cent. were suitable on all grounds.

PROFESSOR GREENWOOD asked whether, in Mr. Dale's opinion, the number of lads who, although of employable age, did not succeed in obtaining employment at all, and so would not normally come within the ambit of the official statistics, would be sufficiently large to make a sensible addition to the total volume of "idle" time.

He also suggested that possibly Mr. Dale and some subsequent speakers had rather exaggerated the extent to which the general public misconceived the purport of the official data. He did not think that when the man in the street read that in January the number of totally unemployed persons was, say, 3 million and in February, say, again 3 million, that the reader supposed the *individuals* to be identical. Indeed the common metaphor used was that of the *army* of unemployed, and every man in the street knew quite well that even if the army establishment were kept constant the individuals composing it were always changing. One obvious way of avoiding any possible misconception would be to adopt actuarial nomenclature and to think in terms not of persons but of person-years or months.

MR. S. L. BESSO said he was deterred by the fact that the Ministry of Labour seemed to be making a corner of this discussion, and therefore he had felt grateful that someone who claimed to be a member of the public had said a word in addition to the officials and ex-officials.

In his paper Mr. Dale had made it clear that the hard core was something that shrinks and swells. Mr. Reeder suggested a real core

of something perhaps over fifty thousand: but the number of people who at any given time could be pointed to as having been continuously unemployed for a long period, varied with the state of trade, as might be expected; Mr. Dale, in reading his paper, remarked that since July there had been a reduction in the number of people who had been out of work for more than a year, *i.e.* a number of people who had been out of work for a year or more previously had since obtained employment. This was a matter of some comfort, because it meant that the people who in common language were said to have gone out of insurance had not really gone out of industrial life. A very substantial majority of the unemployed were perfectly fit for employment and would get work again if trade were to improve.

Mr. Clay had suggested that the number of people in the major industries was inflated because people who were not properly to be regarded as in those industries were included in the figures. The answer was implicit in Mr. Dale's paper. The number of people who were attached to the cotton trade, coal trade or shipbuilding industry were for the most part available for employment if trade improved, and many who had been regarded as unlikely to re-enter employment in those trades had in fact re-entered.

With reference to public works contracting, a considerable number of people obtained temporary employment on work which had been expedited in order to give some relief to current unemployment. They were largely drawn from depressed industries, and when the works upon which they were engaged were completed, they were counted as unemployed members of the public works contracting industry, if they did not obtain work in another. It was not a case of the inflation of an industry, but one of meeting an emergency by giving employment in the industry to people gathered from other trades.

Mr. Dale's figures suggested another interesting inference, which was that the unemployment figures for road-mending and similar occupations indicated to some extent the growth of unemployment in agriculture, which was not insured against unemployment. A large number of land workers were unemployed owing to new methods of agriculture, particularly mechanization, and many of these men were attracted into such insured occupations as road-mending. When they were again unemployed, they were counted among the unemployed in the insured industry, although the figures in some measure represented unemployment in agriculture.

Mr. Besso concluded by thanking Mr. Dale for the distinction he had brought to the Ministry of Labour by giving this very interesting and instructive paper to the Society.

MR. DALE in reply, said: Before this meeting began, Mr. Macrosty said to me, "When you come to reply, if it is late, all you need say is that you note the criticisms and will deal with them in the *Journal*." I was proposing to do that anyhow, whether it were late or not. I would, however, like to say how very grateful I am to you for the kind way in which you have received my paper. I feel rather like a minnow among the whales; with a man like Professor Clay in the offing, and a man like Mr. Flux in front of me,

I would not dare to reply to criticisms without the very fullest consideration. Professor Clay has himself made a great contribution to our understanding of the unemployment problem; it is commonly believed that he wrote the second chapter of the report of the Royal Commission on Unemployment Insurance, and I do not think that that could be improved upon as an exposition on the nature of unemployment. I should also like to acknowledge that we in the Ministry of Labour have had a good deal of inspiration from this Society in the past, as Professor Hilton and Mr. Ramsbottom, our past and present Directors of Statistics, would be the first to admit.

MR. DALE subsequently wrote that, having read the report of the discussion, he wished to thank Mr. Oswald George for drawing attention to what was actually a clerical error, now amended. Mr. Ramsbottom and Mr. Reeder had dealt with suggestions and criticisms made during the discussion, and it did not appear to him that there was anything further to add, except that it might be interesting to supplement the figures in Tables A, B, and D, as follows:—

A. *Number of Applicants for Transitional Payments.*

							Men.	Women.
August .	.	.	.	.	.	.	1003	62
November	.	.	.	.	.	.	975	58

B. *Number out of work for over a Year.*

							Men.	Women.
September	.	.	.	.	.	.	457	21
November	.	.	.	.	.	.	441	19

D. *Number claiming Benefit without the 30 Contributions.*

							Men.	Women.
August .	.	.	.	.	.	.	667	35
November	.	.	.	.	.	.	686	36

As a result of the ballot taken during the meeting, the following candidates were unanimously elected Fellows of the Society :

John Ainsworth Dale, C.B.E.
 Bernard Phineas Dudding.
 William Howieson Gibson, O.B.E.,
 D.Sc.

Percival Goodfellow.
 William Joseph Jennett, B.Sc.
 Leonard William Francis Millis, B.Sc.
 William Joseph Lyndon Norwood.

MISCELLANEA.

CONTENTS.

	PAGE
Recent Advances in Mathematical Statistics (1932). By J. O. IRWIN, M.A., D.Sc.	114
Indian Agricultural Statistics. By H. SINHA, Ph.D., Calcutta University	155

RECENT ADVANCES IN MATHEMATICAL STATISTICS (1932).

By J. O. IRWIN, M.A., D.Sc.

(of the Division of Epidemiology and Vital Statistics, London School of Hygiene and Tropical Medicine).

CONTENTS.

	PAGE
I. Semi-Invariants of Sampling Distributions and Related Topics ...	114
II. Exact Sampling Distributions	119
III. Orthogonal Polynomials	134
IV. Theories of Statistical Inference	134
V. Mathematical Epidemiology	142
VI. Other Investigations	144
VII. Bibliography and References	148

THIS, the third article of the above series, covers the year 1932; as before, there is a certain amount of overlap with the preceding and the following year. It is becoming increasingly clear that the range of mathematical statistics is widening so rapidly that it will shortly be quite impossible for a single reviewer to cover the field; the author is, however, hopeful of securing collaboration in the near future.

As it is, he has been obliged to limit the scope of the article somewhat; for instance, no actuarial literature is included unless it is thought likely to be of general interest from the point of view of mathematical statistics. This latter limitation is, however, no drawback, as an excellent survey of actuarial literature now appears regularly in the *Journal of the Institute of Actuaries* (see, for instance, Vol. LXIII, pp. 484-88, 1932).

In choosing topics for discussion, a selection is obviously necessary and here the author can only rely on his personal judgment. It is hoped, however, that the bibliography is, within its limits, reasonably complete.

I. *Semi-Invariants of Sampling Distributions and Related Topics.*

The most noteworthy paper on this subject in the period under consideration is that of St. Georgescu (A 79), who, by a new method of attack, obtains many new results in addition to some already

given by C. C. Craig (C 1). He obtains general expressions for the moments and semi-invariants of the moments and semi-invariants of univariate and multivariate distributions in sampling from an unlimited universe. The novelty of his method consists in the algebra arranging itself naturally in groups of terms involving the successive powers of $\frac{1}{N}$, the sample size; the approximation may thus be stopped at any convenient point. This end is achieved by means of what he calls associated functions.

If $y_1, y_2 \dots y_i$ be a set of variables and $\{y_i, y_i \dots y_{ip}\}$ denotes the mean product of the variables included in the bracket, the expression

$$\alpha_p(u_1, u_2 \dots u_p) = \sum_1^t i_1 \sum_1^t i_2 \dots \sum_1^t i_p \{y_{i_1} y_{i_2} \dots y_{i_p}\} \frac{u_1^{i_1}}{i_1!} \frac{u_2^{i_2}}{i_2!} \dots \frac{u_p^{i_p}}{i_p!} \dots \quad (1)$$

is the function associated with the p th order product moments of the set. Similarly $\beta_p(u_1, u_2 \dots u_p)$ may be defined as the function associated with the p th order semi-invariants of the set. The definition is identical with the preceding one, except that instead of the product moment $\{y_{i_1} y_{i_2} \dots y_{i_p}\}$ we substitute the corresponding semi-invariant.

$$\text{If} \quad g(t) = y_1 t + y_2 \frac{t^2}{2!} + \dots + y_p \frac{t^p}{p!} + \dots \quad (2)$$

and Fdv is the elementary probability of the event $(y_1, y_2 \dots y_p)$, it is easily shown that

$$\alpha_p(t_1, t_2 \dots t_p) = \int_{(D)} F g(t_1) g(t_2) \dots g(t_p) dv \quad (3)$$

Hence a "characteristic function," though not the one generally employed, may be defined as

$$\Psi(t_1, t_2 \dots t_n \dots) = \int_{(D)} F e^{\lambda[g(t_1) + g(t_2) + \dots + g(t_n) + \dots]} dv \quad (4)$$

$$= 1 + \frac{\lambda}{1!} \sum_i \alpha_1(t_i) + \frac{\lambda^2}{2!} \sum_{ij} \alpha_2(t_i, t_j) + \dots \quad (5)$$

and this may be shown to be equal to

$$e^{\frac{\lambda}{1!} \sum_i \beta_1(t_i) + \frac{\lambda^2}{2!} \sum_{ij} \beta_2(t_i, t_j) + \dots} \quad (6)$$

from which the relation between the β 's and the α 's may be obtained. The integrations (D) are over the whole range of possible values of the y 's.

The author's method of procedure is to form the expression (3)

for the set of moments or semi-invariant deviations in which he is interested. The expansion of (4) then gives the associated functions of the combined sampling distributions of all the moment or semi-invariant deviations.

The author first finds the associated functions of the distribution of moments about a fixed origin (in sampling from a univariate population). This he does by taking

$$\begin{aligned} g(t) &= \frac{t}{1!} \delta m_1' + \frac{t^2}{2!} \delta m_2' + \dots + \frac{t^p}{p!} \delta m_p' + \dots \\ &= \frac{1}{N} \sum_i^N (e^{x_i t} - e^{\phi(t)}) \dots \dots \dots (7) \end{aligned}$$

where $e^{\phi(t)}$ is the characteristic function of the distribution of x , i.e.

$$\begin{aligned} e^{\phi(t)} &= e^{s_1 t + \frac{s_2 t^2}{2!} + \dots + \frac{s_p t^p}{p!} + \dots} \\ &= 1 + \frac{m_1 t}{1!} + \frac{m_2 t^2}{2!} + \dots + \frac{m_q t^q}{q!} + \dots \dots (8) \end{aligned}$$

This leads to

$$\Psi(t_1, t_2 \dots t_n \dots) = [\psi(t_1, t_2 \dots t_n \dots)]^N$$

where

$$\psi(t_1, t_2 \dots t_n \dots) = \int_{-\infty}^{\infty} f(x) e^{\frac{\lambda}{N} \sum_r (e^{x_r t} - e^{\phi(t_r)})} dx \dots (9)$$

He then shows how this expression may be expanded to obtain the associated functions of the moment deviations about a fixed origin. He also extends the process to moment deviations of bivariate distributions. This leads to formulæ of the type

$$\begin{aligned} \{\delta m_i' \delta m_j' \delta m_k'\} &= \frac{1}{N^2} \{m_{i+j+k} - m_i m_{j+k} - m_j m_{k+i} \\ &\quad - m_k m_{i+j} + 2m_i m_j m_k\} \dots \dots (10) \end{aligned}$$

and

$$\begin{aligned} \{\delta m'_{i_1, j_1} \delta m'_{i_2, j_2} \delta m'_{i_3, j_3}\} &= \frac{1}{N^2} \{m_{i_1-i_2-i_3, j_1+j_2+j_3} - m_{i_1, j_1} m_{i_2+i_3, j_2+j_3} \\ &\quad - m_{i_2, j_2} m_{i_3+i_1, j_3+j_1} - m_{i_3, j_3} m_{i_1+i_2, j_1+j_2} + 2m_{i_1, j_1} m_{i_2, j_2} m_{i_3, j_3}\} (11) \end{aligned}$$

With regard to the semi-invariant deviations the expression analogous to (8) for the sample yields as a first approximation

$$\begin{aligned} G_1(t) &= \frac{t}{1!} \delta_1 s_1' + \frac{t^2}{2!} \delta_1 s_2' + \dots + \frac{t^p}{p!} \delta_1 s_p' + \dots \\ &= \left(\frac{t}{1!} \delta m_1' + \frac{t^2}{2!} \delta m_2' + \dots + \frac{t^q}{q!} \delta m_q' + \dots \right) e^{-\phi(t)} (12) \end{aligned}$$

from which the moments and semi-invariants of the combined sampling distributions of all the quantities $\delta_1 s'$ may be obtained

by finding the functions associated with $G_1(t)$, using relation (3). But we may also derive approximations of higher order for the quantities $\delta s'$, say up to terms including r th order products of the δm 's.

If these approximations be called $\delta_r s'$ and

$$G_r(t) = \frac{t}{1!} \delta_r s'_1 + \frac{t^2}{2!} \delta_r s'_2 + \dots + \frac{t^p}{p!} \delta_r s'_p + \dots \quad (13)$$

it may be shown that

$$G_r(t) = G_1(t) - \frac{1}{2}(G_1(t))^2 + \frac{1}{3}(G_1(t))^3 + \dots + \frac{(-1)^{r-1}}{r}(G_1(t))^r \quad (14)$$

By this expression any desired degree of approximation in the semi-invariants or product moments of the semi-invariants of the sample may be obtained. For any function associated with $G_r(t)$ may be expressed in terms of the functions associated with $G_1(t)$ which the author gives in detail. The author also deals with the associated function of the distribution of sampling product moments *about their mean*, and the paper concludes with two useful tables; one giving the second order semi-invariants of the semi-invariants of the sample up to weight twelve as far as terms in $\frac{1}{N^2}$, the other giving the semi-invariants of the product moments of the sample about the mean of the sample up to weight twelve.

O'Toole (A 62) has extended to symmetric functions of more than one variable, a method previously given by him (C 10) of expressing symmetric functions as rational integral algebraic functions of the power sums.

If

$$\begin{array}{c} x_1, x_2, \dots, x_n \\ y_1, y_2, \dots, y_n \end{array}$$

are two sets of n variates of which x_i, y_i are corresponding pairs, the sum of all such terms as

$$\begin{aligned} x_1^{a_1} x_2^{a_2} \dots x_{n_1}^{a_{n_1}} x_{n_1+1}^{a_1} \dots x_{n_1+n_2}^{a_2} \dots y_1^{b_1} y_2^{b_2} \dots y_{m_1}^{b_1} \\ \times y_{m_1+1}^{b_2} \dots y_{m_1+m_2}^{b_2} \dots \end{aligned}$$

may be written

$$(a_1^{n_1} a_2^{n_2} a_3^{n_3} \dots b_1^{m_1} b_2^{m_2} b_3^{m_3} \dots)$$

where

$$a_1, a_2, a_3 \dots, b_1, b_2, b_3 \dots, n_1, n_2, n_3 \dots, m_1, m_2, m_3 \dots$$

are positive integers where

$$\begin{aligned} a_1 > a_2 > a_3 \dots > 0 \\ n_1 + n_2 + n_3 + \dots = m_1 + m_2 + m_3 + \dots \end{aligned}$$

The symmetric function may be said to be of weight

$$w_1 = a_1 n_1 + a_2 n_2 + a_3 n_3 + \dots \text{ in } x,$$

and of weight

$$w_2 = b_1 n_1 + b_2 n_2 + b_3 n_3 + \dots \text{ in } y.$$

It is assumed without loss of generality that $w_1 \geq w_2$. The problem is to express the symmetric function as a rational integral, algebraic function of the power sums

$$s_{11}, s_{12}, s_{21} \dots s_{w_1, w_2}$$

where

$$s_{hk} = \sum_{i=1}^u x_i^h y_i^k \quad h = 1, 2 \dots w_1 \quad k = 1, 2 \dots w_2$$

The method adopted is as follows:—

If

$$(a_1^{n_1} a_2^{n_2} \dots b_1^{m_1} b_2^{m_2} \dots) = f(s_{11}, s_{12} \dots s_{ij} \dots s_{w_1, w_2}) \quad (15)$$

then the introduction of a new pair of variates $x_{n+1} = \alpha$, $y_{n+1} = \beta$ will change f into

$$\sum_{r=0}^{r=w_2} \frac{1}{r!} (\alpha \beta d_{11} + \alpha \beta^2 d_{12} + \dots + \alpha^i \beta^j d_{ij} + \dots + \alpha^{w_1} \beta^{w_2} d_{w_1, w_2})^r f$$

where

$$d_{ij} = \frac{\partial}{\partial s_{ij}} \quad d_{ij}^k = \frac{\partial^k}{\partial s_{ij}^k} \dots i = 1 \dots w_1, j = 1 \dots w_2 \quad (16)$$

This expression may be written in the form

$$(1 + \alpha \beta D_{11} + \alpha \beta^2 D_{12} + \dots + \alpha^i \beta^j D_{ij} + \dots) f. \quad (17)$$

whence the relation between the operators D and d may be written

$$D_{ij} = \sum \frac{d_{i_1, j_1}^{k_1} d_{i_2, j_2}^{k_2} d_{i_3, j_3}^{k_3} \dots}{k_1! k_2! k_3! \dots} \quad i = 1 \dots w_1, j = 1 \dots w_2$$

where

$$\begin{aligned} k_1 i_1 + k_2 i_2 + k_3 i_3 + \dots &= i \\ k_1 j_1 + k_2 j_2 + k_3 j_3 + \dots &= j \end{aligned} \quad (18)$$

$i_1, i_2, i_3 \dots j_1, j_2, j_3 \dots k_1, k_2, k_3$ being positive integers

$$\text{or} \quad d_{ij} = \Sigma (-1)^{r+1} (v-1)! \frac{D_{i_1, j_1}^{k_1} D_{i_2, j_2}^{k_2} D_{i_3, j_3}^{k_3} \dots}{k_1! k_2! k_3! \dots}$$

where

$$\begin{aligned} i &= 1 \dots w_1 & j &= 1 \dots w_2 \\ k_1 i_1 + k_2 i_2 + \dots &= i \\ k_1 j_1 + k_2 j_2 + \dots &= j \\ k_1 + k_2 + \dots &= v \end{aligned} \quad (19)$$

The effect of introducing the new variates on the left-hand side of (15) is to replace it by

$$\begin{aligned} \alpha^{a_1} \beta^{b_1} (a_1^{n_1-1} a_2^{n_2} a_3^{n_3} \dots b_1^{m_1-1} b_2^{m_2} b_3^{m_3} \dots) \\ + \alpha^{a_2} \beta^{b_2} (a_1^{n_1} a_2^{n_2-1} a_3^{n_3} \dots b_1^{m_1} b_2^{m_2-1} b_3^{m_3} \dots) + \text{etc.} \end{aligned} \quad (20)$$

whence equating coefficients of like terms in α and β in (17) and (20) we can show

$$\begin{aligned} D_{a_1 b_1} (a_1^{n_1} a_2^{n_2} a_3^{n_3} \dots b_1^{m_1} b_2^{m_2} b_3^{m_3} \dots) \\ = (a_1^{n_1-1} a_2^{n_2} a_3^{n_3} \dots b_1^{m_1-1} b_2^{m_2} b_3^{m_3} \dots) \\ D_{a_2 b_2} (a_1^{n_1} a_2^{n_2} a_3^{n_3} \dots b_1^{m_1} b_2^{m_2} b_3^{m_3} \dots) \\ = (a_1^{n_1} a_2^{n_2-1} a_3^{n_3} \dots b_1^{m_1} b_2^{m_2-1} b_3^{m_3} \dots) \text{ etc.} \\ \text{and } D_{h h} (a_1^{n_1} a_2^{n_2} a_3^{n_3} \dots b_1^{m_1} b_2^{m_2} b_3^{m_3} \dots) = 0 \dots \end{aligned}$$

if both h and k are not among $a_1, a_2, a_3 \dots b_1, b_2, b_3$. (21)

Any symmetric function can now be expressed as a linear function of all the products of the power sums having the right weight, and the unknown coefficients determined by operating on the right-hand side with suitable D 's and on the left-hand side with their corresponding d 's.

For example, we may write:—

$$(21 \cdot 1^2) = c_1 s_{21} s_{11} + c_2 s_{32},$$

these being the only two terms which satisfy the weight conditions. Operating on the left with D_{21} and on the right with d_{21} gives

$$(1 \cdot 1) = c_1 s_{11} \text{ or } c_1 = 1.$$

Operating on the left with D_{32} and on the right with $d_{32} + d_{11} d_{21}$ gives $0 = c_1 + c_2$, or $c_2 = -1$. Thus:—

$$(21 \cdot 1^2) = s_{21} s_{11} - s_{32} \dots \dots \dots (22)$$

Similarly we may write

$$\begin{aligned} (321 \cdot 1^3) = c_1 s_{63} + c_2 s_{52} s_{11} + c_3 s_{51} s_{12} + c_4 s_{42} s_{21} + c_5 s_{41} s_{22} \\ + c_6 s_{41} s_{11}^2 + c_7 s_{32} s_{31} + c_8 s_{31} s_{21} s_{11} + c_9 s_{21}^3. \end{aligned}$$

By operating on the right with

$$d_{12}, d_{11}^2, d_{21}^2, d_{31} d_{21} d_{11}, d_{31} d_{32}, d_{41} d_{22}, d_{42} d_{21}$$

and on the left with their equivalent D 's, the author shows

$$(321 \cdot 1^3) = 2s_{63} - s_{52} s_{11} - s_{42} s_{21} - s_{32} s_{31} + s_{31} s_{21} s_{11} \dots (23)$$

The operational relations may be extended for any number of variable greater than two and have a similar form.

II. *Exact Sampling Distributions.*

In this field some important advances have been made by Wilks (A 84, 85, 86, 87). It will be remembered that Fisher originally determined the exact distribution of the multiple correlation coefficient in sampling from a normal population (C 3) and that his argument depended on multi-dimensional geometrical reasoning

which many people find difficult to follow. It is therefore useful to have a demonstration which depends on algebraic methods only, and with this Wilks provides us (A 85), making use of moment generating functions.

He supposes a sample of N items to be drawn at random from the normal n -variate population whose distribution is

$$\frac{\sqrt{A}}{(2\pi)^{\frac{n}{2}}} e^{-\frac{1}{2} \sum_{i,j=1}^n A_{ij}(x_i - m_i)(x_j - m_j)} \prod dx_i \quad . \quad . \quad . \quad (24)$$

where $A_{ij} = \frac{\Delta_{ij}}{\sigma_i \sigma_j \Delta}$, $\Delta = |\rho_{ij}|$ the determinant of correlations among the n variates, Δ_{ij} is the co-factor of ρ_{ij} in Δ , σ_i is the standard deviation of x_i and A is the determinant $|A_{ij}|$.

In the sample he takes

$$\bar{x}_i = \frac{1}{N} \sum_{\alpha=1}^N x_{i\alpha}$$

and

$$a_{ij} = \frac{1}{N} \sum_{\alpha=1}^N (x_{i\alpha} - \bar{x}_i)(x_{j\alpha} - \bar{x}_j) \quad . \quad . \quad . \quad (25)$$

where $x_{i\alpha}$ is the value of x_i for the α th individual of the sample. He uses Wishart's formula for the simultaneous distribution of the set $\{a_{ij}\}$, ($i, j \dots = 1, 2 \dots n$), which is

$$f(\bar{a}) d\bar{a} = \frac{\left(\frac{N}{2}\right)^{\frac{n(N-1)}{2}} A^{\frac{N-1}{2}}}{\pi^{\frac{n(n-1)}{4}} \Gamma\left(\frac{N-1}{2}\right) \Gamma\left(\frac{N-2}{2}\right) \dots \Gamma\left(\frac{N-n}{2}\right)} e^{-\frac{N}{2} \sum_{i,j=1}^n A_{ij} a_{ij}} |a_{ij}|^{\frac{N-n-2}{2}} d\bar{a} \quad (26)$$

where $|a_{ij}|$ is the determinant of the a 's.

He defines a moment generating function

$$\phi(x, \kappa) = \int e^{a_{11} \kappa} |a_{ij}|^k |a_{pq}|^{-k} f(\bar{a}) d\bar{a} \quad . \quad . \quad . \quad (27)$$

where the integration is to be taken over the field of all possible values of the a 's and $|a_{pq}|$ is the co-factor of a_{11} in $|a_{ij}|$. From this definition of $\phi(x, \kappa)$ it is shown that

$$\left[\frac{\partial^h}{\partial \kappa^h} \phi(x, \kappa) \right]_{\kappa=0} = E[a_{11}^{h+k} (1 - R^2)^k] \quad . \quad . \quad (28)$$

where R is the value of the multiple correlation coefficient calculated from the sample.

Wilks then shows that this expectation exists for $h = -k$ and

so obtains the k th moment of $(1 - R^2)$, finally showing that Fisher's distribution function is the only function which will have these moments.

It will be remembered that Fisher obtained two different distributions for the multiple correlation coefficient which he calls (A) and (C), appropriate respectively to the cases where the independent variables have and where they have not sampling errors. Both were shown to tend to another form (B) when the size of sample is increased indefinitely.

Now these results may at once be extended to give the distribution of the correlation ratio. For suppose we have a series of arrays of a variable x and are concerned with the correlation ratio of another variable y on x . Then we might fit a polynomial to the means of the arrays of sufficiently high degree to pass through all the means exactly. If there are p arrays it will be of degree $(p - 1)$. Now if the polynomial is fitted in orthogonal form, we may suppose $X_1, X_2 \dots X_{p-1}$ to be the orthogonal contributions of degree 1, 2, 3 $\dots p - 1$, the final result being $\sum_1^{p-1} A_r X_r$, the A 's being determined by least squares. Then the correlation ratio will be the multiple correlation coefficient between Y and $X_1, X_2 \dots X_{p-1}$, for $1 - \eta^2$ is defined as the mean square deviation of all the observations from the means of their own arrays and $1 - R^2$ as the mean square deviation from the values of the fitted regression function, and these have been made the same.

Further, if the number of observations in each array remains the same from sample to sample, so will the quantities $X_1, X_2 \dots X_{p-1}$, since they depend only on the moments of the variate x , and the distribution of η^2 is clearly obtained from Fisher's C distribution.

Wishart (A 89) utilizes this fact stated very briefly by Fisher (C 3) to determine the mean and standard deviation in sampling of the correlation ratio appropriate to the latter case. He shows in the first place that if $x(=E^2)$ be the square of the correlation ratio in the sample, η^2 in the population, if there are N observations and p arrays and if

$$t = \frac{N\eta^2}{2(1 - \eta^2)} \quad a = \frac{1}{2}(p - 1) \quad b = \frac{1}{2}(N - p),$$

the distribution of the correlation ratio may be written

$$df = e^{-t} \frac{(a + b - 1)!}{(a - 1)!(b - 1)!} x^{a-1} (1 - x)^{b-1} \\ \times \left[1 + \frac{a + b}{1! a} (tx) + \frac{(a + b)(a + b - 1)}{2! a(a + 1)} (tx)^2 + \dots \right] dx \quad (29)$$

Now b is either an integer or a half-integer; if b is an integer the above distribution may be written in the form

$$df = \frac{e^{-t}}{(b-1)!} (1-x)^{b-1} \frac{d^b}{dx^b} (x^{a+b-1} e^{tx}) dx \quad (30)$$

Wishart finds for the mean value

$$\bar{E}^2 = 1 - \frac{b}{a+b} F(1, a+b+1, -t) \quad (31)$$

where F is the confluent hypergeometric series given by

$$F(\alpha, \gamma, x) = 1 + \frac{\alpha}{\gamma} x + \frac{\alpha(\alpha+1)}{2! \gamma(\gamma+1)} x^2 + \dots$$

and gives a transformation appropriate to the case when $(a+b)$ is not large compared with t .

For the standard deviation of E^2 he finds

$$\sigma_{E^2}^2 = \frac{b(b+1)}{(a+b)(a+b+1)} F(2, a+b+2, -t) - (1 - \bar{E}^2)^2 \quad (32)$$

and discusses the two forms appropriate for calculation.

That the same results also hold when b is a half-integer is shown by an ingenious use of the theory of fractional differentiation; in this case the probability integral is found to be

$$df = \frac{e^{-t}}{(b-1)!} (1-x)^{b-1} \frac{d^{b+\frac{1}{2}}}{dx^{b+\frac{1}{2}}} \left[\int_0^x \frac{\xi^{a+b-1} e^{t\xi} d\xi}{\sqrt{\pi(x-\xi)}} \right] \quad (33)$$

from which the same result as before for the mean and variance is obtained.

Finally, it is shown that the mean and variance appropriate for the case of fixed array number, tend in common with the analogous results for the case of variable array number already given by the author (C 11) to the corresponding parameters of Fisher's B distribution, when the size of sample is indefinitely increased.

We must now return to Wilks. In an able paper (A 87) he gives "Certain Generalizations in the Analysis of Variance" of the greatest interest. If we have a normal multivariate population with n variates, we may regard the determinant $|\sigma_i \sigma_j \rho_{ij}|$ where σ_i is the standard-deviation of the i th variate, ρ_{ij} the correlation between the i th and j th variates, as the "generalized variance" of the population. The "generalized variance" of a sample of N individuals is defined as the determinant $|a_{ij}|$ of the elements defined in equation (25). Wilks finds the sampling distribution of $|a_{ij}|$ and a number of related functions. He uses the method of moment

generating functions, and his success depends on the fact that he has found solutions to the two integral equations:—

$$\int_0^\infty z^k f(z) dz = B^k \frac{\Gamma(a_1 + k) \Gamma(a_2 + k) \dots \Gamma(a_n + k)}{\Gamma(a_1) \Gamma(a_2) \dots \Gamma(a_n)} \quad (34)$$

$$\int_0^B w^k g(w) dw = CB^k \frac{\Gamma(b_1 + k) \Gamma(b_2 + k) \dots \Gamma(b_n + k)}{\Gamma(c_1 + k) \Gamma(c_2 + k) \dots \Gamma(c_n + k)} \quad (34 \text{ bis})$$

The functions $f(z)$ and $g(w)$ may, in fact, be expressed as $(n-1)$ -fold integrals which may be integrated out explicitly for certain special values of the parameters a, b, c and small values of n .

We have, in fact:—

$$f(z) = \frac{B^{-a_n} z^{a_{n-1}}}{\Gamma(a_1) \Gamma(a_2) \dots \Gamma(a_n)} \int_0^\infty \int_0^\infty \dots \int_0^\infty v_1^{a_1 - a_1 - 1} v_2^{a_2 - a_2 - 1} \dots v_{n-1}^{a_{n-1} - a_{n-1} - 1} \times e^{-v_1 - \frac{v_2}{v_1} \dots - \frac{v_{n-1}}{v_{n-2}} - \frac{z}{B v_{n-1}}} dv_1 dv_2 \dots dv_{n-1} \quad (35)$$

The expression for $g(w)$ is rather more complicated and need not be quoted here.

The distribution of $\xi = |a_{ij}|$ is found to be $D(\xi) d\xi$ where

$$D(\xi) = \frac{A^{\frac{N-n}{2}} \xi^{\frac{N-n-2}{2}}}{\prod_{i=2}^n \Gamma\left(\frac{N-i}{2}\right)} \int_0^\infty \int_0^\infty \dots \int_0^\infty (v_1 v_2 \dots v_{n-1})^{-\frac{1}{2}} \times e^{-v_1 - \frac{v_2}{v_1} \dots - \frac{v_{n-1}}{v_{n-2}} - \frac{\xi}{v_{n-1}}} dv_1 dv_2 \dots dv_{n-1} \quad (36)$$

where the range of ξ is from 0 to ∞

$$\text{and} \quad A = \frac{N^n}{2^n \sigma_1^2 \sigma_2^2 \dots \sigma_n^2 \Delta}$$

Δ being the determinant of population correlations $|\rho_{ij}|$. For $n=1$, this reduces to the well-known distribution of the variance in samples from a univariate population:

$$D_1(\xi) = \frac{\left(\frac{N}{2\sigma^2}\right)^{\frac{N-1}{2}}}{\Gamma\left(\frac{N-1}{2}\right)} \xi^{\frac{N-3}{2}} e^{-\frac{N\xi}{2\sigma^2}} \quad (37)$$

for $n=2$

$$D_2(\xi) = \frac{2^{\frac{N-3}{2}} A_2^{\frac{N-2}{2}} \xi^{\frac{N-4}{2}}}{\Gamma(N-2)} e^{-2\sqrt{A_2}\xi} \quad (37 \text{ bis})$$

where

$$A_2 = \frac{N^2}{4\sigma_1^2 \sigma_2^2 (1 - \rho_{12}^2)}$$

The author also gives :—

(i) The moments and distribution of the ratio of two independent generalized variances, containing the same or different numbers of variables; explicit expressions are found for the case of two variates and for the ratio of the variance in a sample of one variate to the square root of the generalized variance in a sample of two variates.

(ii) The distribution of the ratio of an *independent generalized variance to any of its principal minors of the t^{th} order*. If the determinant $|a_{ij}|$ is rearranged so that the principal minor in question stands in the upper left-hand corner, the distribution is given by $f(\phi)d\phi$ where

$$f(\phi) = \frac{B^{\frac{N-n}{2}} \phi^{\frac{N-n}{2}-1}}{\prod_{i=t+1}^n \Gamma\left(\frac{N-i}{2}\right)} \int_0^\infty \int_0^\infty \dots \int_0^\infty (v_1 v_2 \dots v_{n-t-1})^{-\frac{1}{2}} \\ \times e^{-v_1 - \frac{v_2}{v_1} \dots - \frac{v_{n-t-1}}{v_{n-t-2}} - \frac{B\phi}{v_{n-t-1}}} dv_1 dv_2 \dots dv_{n-t-1} \quad (38)$$

where

$$B = \frac{N^{n-t} \Delta^{(t)}}{2^{n-t} \sigma_{t+1}^2 \dots \sigma_n^2 \Delta}$$

As a particular case when $t = n - 1$ we have the distribution of the variance of the difference between the n^{th} variate and its estimate from the regression plane of the remaining $(n - 1)$ variates

$$f_1(\phi) = \frac{B_1^{\frac{N-n}{2}}}{\Gamma\left(\frac{N-n}{2}\right)} \phi^{\frac{N-n}{2}-1} e^{-B_1 \phi} \quad (39)$$

where $B_1 = \frac{N}{2\sigma_n^2(1-R^2)}$ and R is the multiple correlation coefficient between the n^{th} variate and the first $n - 1$ variates.

(iii) The distribution of a *generalisation of the correlation ratio*. If p samples ω_β ($\beta = 1, 2 \dots p$) of N_β items respectively be drawn from a normal population of one variable and if \bar{x}_β and s_β^2 are the mean and variance of ω_β , while Ω is the sample formed by pooling the ω 's and has a mean and variance given by \bar{X} and s^2 , then the correlation ratio is given by

$$\eta^2 = \frac{\sum_{\beta=1}^p N_\beta (\bar{x}_\beta - \bar{X})^2}{N s^2} \left(\sum_{\beta=1}^p N_\beta = N \right) \quad (40)$$

η^2 is of course the ratio of the weighted variance of the means of the p sub-samples ω_β to the variance of Ω .

The generalization is obtained as follows :—We suppose p samples

$\omega'_\beta (\beta = 1, 2 \dots p)$ of n_β items respectively to be drawn from an n -variate normal population. Let the sample formed by pooling the ω 's be Ω' , which will have $\sum_{\beta=1}^p n_\beta = N$ items. The generalized correlation ratio is the ratio of the generalized weighted variance of the means of ω 's to the generalized variance of Ω' . That is

$$U = \frac{|b_{ij}|}{|a_{ij}|}$$

where

$$b_{ij} = b_{ji} = \frac{1}{N} \sum_{\beta=1}^p n_{\beta} (\bar{X}_{i\beta} - \bar{X}_i)(\bar{X}_{j\beta} - \bar{X}_j)$$

$$a_{ij} = a_{ji} = \frac{1}{N} \sum_{\beta=1}^p \sum_{\alpha=1}^n (x_{i\beta\alpha} - \bar{X}_i)(x_{j\beta\alpha} - \bar{X}_j)$$

where $\bar{X}_{i\beta}$ is the mean of the i th variate in the β th sample and $x_{i\beta\alpha}$ is the value of the α th individual for the i th variate in the β th sample ω'_β .

The author points out that we may write

$$a_{ij} = b_{ij} + c_{ij}. \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (41)$$

where

$$c_{ij} = \frac{1}{N} \sum_{\beta=1}^p \sum_{\alpha=1}^{n_{\beta}} (x_{i\beta\alpha} - \bar{X}_{i\beta})(x_{j\beta\alpha} - \bar{X}_{j\beta}).$$

The ratio

$$W = \frac{|c_{ij}|}{|a_{ij}|}$$

may be regarded as a generalization of $1 - \gamma^2$, and the author also finds its distribution; of course it is only when $n=1$ that $U + W = 1$.

As examples we may give the distributions of U and W when $n = 2$, $\phi_s(U)dU$ and $\theta_s(W)dW$, where

$$\phi_2(U) = \frac{\Gamma\left(\frac{N-1}{2}\right)\Gamma\left(\frac{N-2}{2}\right)U^{\frac{p-4}{2}}(1-U)^{N-p-1}}{\Gamma\left(\frac{p-1}{2}\right)\Gamma\left(\frac{p-2}{2}\right)\Gamma(N-p)} \times F\left(\frac{N-p-1}{2}, \frac{N-p}{2}, N-p, 1-U\right). \quad (42)$$

$$\theta_2(W) = \frac{\Gamma\left(\frac{N-1}{2}\right) \Gamma\left(\frac{N-2}{2}\right) W^{\frac{N-p-3}{2}} (1-W)^{p-2}}{\Gamma\left(\frac{N-p}{2}\right) \Gamma\left(\frac{N-p-1}{2}\right) \Gamma(p-1)} \times F\left(\frac{p-2}{2}, \frac{p-1}{2}, p-1, 1-W\right). \quad (42 \text{ bis})$$

F denoting the hypergeometric series.

(iv) The distribution of the generalization of Student's Ratio previously given by Hotelling. (See (C 4) and (C 7) p. 521.)

This is obtained by first finding the distribution of

$$\gamma = \frac{|a_{ij}|}{|c_{ij}|} \quad . \quad . \quad . \quad . \quad . \quad . \quad (43)$$

where

$$c_{ij} = a_{ij} + (\bar{X}_i - m_i)(\bar{X}_j - m_j),$$

and making use of the fact that

$$\gamma = \frac{1}{1 + \frac{T^2}{N-1}} \quad . \quad . \quad . \quad . \quad . \quad . \quad (43 \text{ bis})$$

where T is the generalized ratio.

(v) The distribution of the λ criterion appropriate to k samples. (See p. 137 and (C 9).)

(vi) The moments and distribution of the ratios of determinants of correlation coefficients, when the variates are uncorrelated in the population sampled. Here the author finds the distribution both of the determinant $|r_{ij}|$ and of the ratio

$$z = \frac{|'c_{ij}|}{\prod_{\beta=1}^k |r_{ij\beta}|} \quad . \quad . \quad . \quad . \quad . \quad . \quad (44)$$

where $|r_{ij\beta}|$ is the β th of k mutually exclusive principal minors placed corner to corner down the main diagonal of $|r_{ij}|$ such that each element in the diagonal is included in one of the minors. The distribution of $1 - R^2$ where R is the multiple correlation coefficient is a particular case of this.

Another paper by the same writer (A 86) examines "The distribution of statistics in samples from a normal population of two variables with matched sampling for one variable." If we wish to compare two groups of individuals in respect of one character, it is advantageous to keep other characters as nearly as possible the same. As an example the author takes the following:—"Suppose it is desired to find the effect of a certain type of diet on the weight of men of a certain age in a typical American university. It is well known that there is considerable correlation between weight and height, and it will be desirable to eliminate the factor of height as far as possible. This may be done by taking two groups, such that for each man of a certain height in one group there is a man of the same height in the second group. Suppose the heights are matched independently of the weights. Let the first group be placed on a standardized or normal diet, and the second group be placed on an experimental diet for the desired length of time.

After the experiment certain statistics (*i.e.* statistical estimates) are calculated from the weights of the two groups. Now the question arises as to what criteria of significance should be used on the difference in the corresponding statistics of the two groups."

Quite clearly the standard errors and sampling distributions of these statistics will be different from what they would have been had the samples been taken completely at random, owing to the correlation between height and weight. Thus the author is led to the consideration of the following problem. Suppose two correlated variates x, y are normally distributed and that samples of s are drawn from this population in such a way that the distribution of the x 's is made identical item by item with a given distribution which may be random or arbitrary, independently of the y 's. What is the sampling distribution of certain linear and quadratic functions of the y 's?

The problem is solved by the method of moment generating functions, but for the details of the solution we must refer the reader to Wilks' paper.

As an example of the kind of results the author obtains we may quote the following:—Let y be the unmatched variable, y_0 its mean value in the population sampled and x and x_0 analogous quantities for the matched variable; then if

$$\bar{F}_y = \sum_{i=1}^s p_i y_i = \sum_{i=1}^s p_i (y_i - y_0) + y_0 \sum_{i=1}^s p_i$$

$$\text{and} \quad \bar{F}_x = \sum_{i=1}^s p_i x_i = \sum_{i=1}^s p_i (x_i - x_0) + x_0 \sum_{i=1}^s p_i$$

where $p_1, p_2 \dots p_s$ is any set of constants, the distribution of $\bar{F}_y = z$ will be given by

$$\Phi(z) = \frac{1}{\sqrt{2\pi\sigma_y}\sqrt{1-r^2}\sqrt{P_2}} e^{-\frac{1}{2\sigma_y^2(1-r^2)P_2}\theta'(z)} \quad . \quad . \quad (45)$$

$$\text{where} \quad \theta'(z) = \left[z - y_0 P_1 - r \frac{\sigma_y}{\sigma_x} (\bar{F}_x - P_1 x_0) \right]^2$$

$$P_1 = \sum_{i=1}^s p_i \quad \quad \quad P_2 = \sum_{i=1}^s p_i^2$$

from which it follows that the expected value of \bar{F}_y is

$$E(\bar{F}_y) = y_0 P_1 + r \frac{\sigma_y}{\sigma_x} (\bar{F}_x - P_1 x_0) \quad . \quad . \quad (46)$$

and the standard error is

$$\sigma_{\bar{F}(y)} = \sigma_y \sqrt{1-r^2} \sqrt{P_2} \quad . \quad . \quad . \quad (47)$$

From this result a number of particular cases of special interest follow; for example, the frequency distribution of the mean of the unmatched variate in one sample, of the difference between the means of two samples, of the sum of the values of the unmatched variate in one sample, and of the difference between the sums of the values in two samples.

The result can also be extended to the distribution of the mean of a variate when the distributions of $(n-1)$ correlated variates are matched with $(n-1)$ arbitrary distributions.

The moments and distribution of the standard deviation of the unmatched variate, as well as its expected value and standard error, are obtained, also the distribution of "Student's z " for the unmatched variate.

As a generalization the author also finds the moments and distribution of the standard deviation of a variate when $(n-1)$ correlated variates are matched with $(n-1)$ arbitrary distributions. Finally, he gives the product moments and simultaneous distribution of $\bar{\mu}_{11}$ and $\bar{\mu}_{02}$, the distribution of the correlation coefficient involving matched variates, and of the regresson coefficient of the unmatched variate on the matched variate where, s being the number of observations

$$\begin{aligned}\bar{\mu}_{11} &= \frac{1}{s} \sum_{i=1}^s (x_i - \bar{x})(y_i - \bar{y}) \\ \bar{\mu}_{02} &= \frac{1}{s} \sum_{i=1}^s (y_i - \bar{y})^2 \quad . \quad . \quad . \quad . \quad (47 \text{ bis})\end{aligned}$$

The algebra in the latter part of the paper is somewhat complex and is handled with great skill.

Still another interesting problem is considered by this versatile writer (A 84). Suppose we have a sample from a normal bivariate population, but the data are incomplete in that there has been a failure to record *both measurements* for *some* individuals, we may ask what are the best estimates of the five parameters, the two means, standard deviations and the correlation coefficient in the population sampled which may be made from the data. These optimum estimates may be made simultaneously by the method of maximum likelihood, and here the author gives an interesting generalization of Fisher's definition of "information" as a quantity, for large samples. Fisher defined the amount of information relative to a single parameter, utilized by a "statistic," as the reciprocal of its variance. Since the sampling variance of a "statistic" estimated by the method of maximum likelihood is a minimum, such an estimate uses the maximum amount of information and the reciprocal of its sampling variance is regarded as the amount of information

in the sample relative to the parameter in question. The "efficiency" of the "statistic" is then the ratio of the amount of information it utilizes, to the total amount of information in the sample.

Now by an ingenious argument, Wilks shows that the determinant of the matrix of variances and covariances, in large samples, of a set of estimates of any number of parameters, which specify either a univariate or a multivariate population, is a minimum when all the estimates are maximum likelihood estimates.

The reciprocal of the determinant may then be regarded as the amount of information relative to the parameters utilized by the estimates, and the efficiency of any set will be the inverse ratio of its determinant to the corresponding determinant formed from the variances and covariances of the maximum likelihood estimates.

Returning to the incomplete data we may suppose that the sample is divided into three parts ω_{xy} consisting of s individuals observed with respect to both x and y , ω_x consisting of m individuals observed with respect to x only, ω_y consisting of n individuals observed with respect to y only.

The solution of the maximum likelihood equation for the simultaneous estimation of all five parameters would be extremely complicated, and for this reason the author considers maximum likelihood estimates for the following sets of conditions:

(a) For given values of σ_x , σ_y and r optimum estimates are found for the means a and b .

(b) For given values of a , b , r optimum estimates are found for σ_x and σ_y .

(c) For given values of a and b approximations are found for the optimum estimates of σ_x , σ_y and r .

From the point of view of practical application these optimum estimates are somewhat complicated in form, though their variances and covariances in large samples are fairly easily obtained. For this reason the author examines somewhat simpler though less efficient sets of estimates.

(i) Means a and b estimated independently from the x 's and y 's respectively of the sample ω .

(ii) Maximum likelihood estimate of σ_x from ω_{xy} and ω_x , and σ_y from ω_{xy} and ω_y each estimated independently of the other. The estimate of $r\sigma_x\sigma_y$ is taken as the covariance from ω_{xy} . Here the author obtains the characteristic function of these estimates.

(iii) Estimates of σ_x and σ_y taken as the square root of the weighted averages of the variances from ω_{xy} and ω_x , and from ω_{xy} and ω_y respectively, with the estimate of r taken as the ratio of the

covariances of ω_{xy} to the product of these estimates of the standard deviations.

(iv) Estimates of σ_x and σ_y the same as in (iii) with r estimated entirely from ω_{xy} .

By a masterly piece of mathematical analysis, the exact form of the sampling distributions of the systems in (iii) and (iv) are found, as well as the asymptotic normal forms approached by these exact distributions as the size of the sample ω increases, subject to the condition that $\frac{m}{s} = \alpha$, $\frac{n}{s} = \beta$ are constant. The efficiency is found for each of the sets of estimates (i), (iii) and (iv); it is interesting that (iv) is a more efficient set than (iii) and also that the variance of the estimate of r obtained from (iv) is less than that obtained from (iii).

Maximum likelihood estimates of a single parameter are known to be normally distributed in large samples with a variance equal to the negative reciprocal of the mathematic expectation of the second partial derivative of the logarithm of the likelihood. Their distribution in small samples is unknown. Carlson (A 11) has conducted an experiment in which he took 100 samples of 3 from a Pearson Type II population, and calculated for each sample the maximum likelihood values of the parameter of location. Their sampling distribution is examined and compared with that of the mean. Their variance is found to be 50 per cent. larger than the value calculated from the large sample formula, and not to differ significantly from the variance of the means of the samples. Of course we do not know how far this result is due to the inaccuracy of the large sample formula, or to faults in the sampling technique. The skewness of the distribution of the maximum likelihood estimates, coupled with the fact that they have $\beta_2 = 3.056$, suggests that the latter may be the more important cause of the discrepancy.

Among other investigations in distribution theory are those of Baker, Baten, A. T. Craig, Fieller, Feldman, and McKay. Baker (A 3) obtains a formula for the distribution of Student's z in samples of two drawn from a composite population consisting of two unequal normal components, and gives also for comparative purposes an experimental sampling distribution of 1038 values of the same quantity calculated from samples of four.

Baten (A 5) gives a table showing the form of the frequency distribution of the sum of n variables, each of which follows the same frequency law, for a variety of forms of the latter. He uses the well-known method of characteristic functions; some of his results are new, but others he gives (as well as some he does not) have been treated before by the same method; for instance, the normal curve

and Pearson's Types I, II, III and VII. The first example he gives is where the individual frequency form is

$$f(x_i) = \frac{2h}{\pi} \frac{1}{(1 + h^2 x_i^2)^2} \quad . \quad . \quad . \quad . \quad . \quad (48)$$

but
$$f(x_i) = \frac{\Gamma(m)}{\Gamma(m - \frac{1}{2})\Gamma(\frac{1}{2})} \frac{1}{(1 + x_i^2)^m} \quad . \quad . \quad (48 \text{ bis})$$

has already been similarly dealt with and the integral

$$\int \frac{\cos(ux)dx}{(1 + x^2)^m}$$

evaluated by an identical method to his (see (C 5) pp. 91-102). The distribution of the sum of two variables each of which follows the law (48) is given by him as

$$p_2(u) = \frac{4h(20 + h^2 u^2)}{\pi(2^2 + h^2 u^2)^3} \quad . \quad . \quad . \quad . \quad . \quad (49)$$

but the correct expression is

$$p_2(u) = \frac{2h(36 + 5h^2 u^2)}{\pi(4 + h^2 u^2)^3} \quad . \quad . \quad . \quad (49 \text{ bis})$$

which, on replacing h by $2h$ and then putting $h = 1$, agrees with the expression given in (C 5) p. 97, equation (61), for the frequency distribution of the mean of samples of two. His table does not make quite clear the fact that the sum of n variables, each of which follows the same Type III distribution, will also be of the Type III form.

A. T. Craig (A 18) discusses the simultaneous distribution of mean and standard deviation in small samples from non-normal populations. The distribution may always be obtained explicitly for samples of two; it may be expressed as a single integral or a sum of such integrals for samples of three, and as a double integral or sum of such integrals for samples of four. The limits present considerable difficulties in the case of limited range populations, and the general solution for samples of four is too complicated for use.

For example, the joint distribution of the mean and standard deviation of samples of two from the population $du = f(x)dx$ is given by

$$F(\bar{x}, s) d\bar{x} ds = 4f(\bar{x} - s)f(\bar{x} + s)d\bar{x} ds \quad . \quad . \quad . \quad (50)$$

and this is valid for all values of \bar{x} and s if the population is of unlimited range. If $f(x)$ is of range $(0 \dots \infty)$, (50) is still valid, but the surface is limited by the \bar{x} axis and the line $s = \bar{x}$. If x is of range $(0 \dots a)$ the surface is limited by the \bar{x} axis and the lines $s = \bar{x}$, $s = a - \bar{x}$. We will not quote at length the results for samples of three, but will note that the author finds the distribution explicitly in the case of samples of two and three from normal exponential and rectilinear populations.

Feldman (A 24) gives the distribution of the precision constant in samples of n from a normal population. By an obvious transformation of the well-known distribution for the variance, the distribution of the precision constant (h) is found to be

$$df = \frac{n^2}{2} \frac{H^{n-1} h^{-n} e^{-\frac{h^2}{2H^2}}}{\frac{n-1}{2} \Gamma\left(\frac{n-1}{2}\right)} dh. \quad (51)$$

and of $u = h^2$

$$df = \frac{n^2}{2} \frac{U^{n-1} u^{-\frac{n}{2}} e^{-\frac{u}{2U}}}{\frac{n-1}{2} \Gamma\left(\frac{n-1}{2}\right)} du. \quad (51 \text{ bis})$$

where H , U are the values of the precision constant and its square in the population sampled. The moments of both distributions are easily found and given up to μ_4 , also the expressions for β_1 and β_2 . The author also finds expressions for the median and quartiles. Tables are given of the first four moments of both distributions for $n = 4, 10, 25, 100$; of β_1, β_2 for $n = 10, 25, 100, \infty$, and of the median and quartiles for $n = 4, 10, 25$.

The author asserts that the distribution of u does not tend to normality as the size of sample increases. This is, however, incorrect and due to an error in his fourth moment, the correct expression for which is

$$\mu_4(u) = \frac{12n^4(n+9)U^4}{(n-3)^4(n-5)(n-7)(n-9)} \quad (52)$$

leading to

$$\beta_2 = \frac{3(n+9)(n-5)}{(n-7)(n-9)} \quad (52 \text{ bis})$$

the limiting value, of which is 3 as it should be.

Fieller (A 25) obtains the frequency distribution of the index $v = \frac{y}{x}$ in sampling from a normal bivariate distribution. His general formula is long, has infinite moments, and need not be quoted here, but if the normal population be curtailed so that x, y lies inside the ellipse

$$\left(\frac{x-\bar{x}}{\sigma_x}\right)^2 - 2r\left(\frac{x-\bar{x}}{\sigma_x}\right)\left(\frac{y-\bar{y}}{\sigma_y}\right) + \left(\frac{y-\bar{y}}{\sigma_y}\right)^2 = \lambda^2 \quad (53)$$

the distribution of the index becomes $I(\lambda) d\lambda$, where

$$I(\lambda) = C_0 \frac{\beta}{\alpha} e^{-\frac{\lambda^2}{(1-r^2)}} \int_0^{\sqrt{\frac{\lambda^2 - \epsilon}{1-r^2}}} \frac{1}{\sqrt{2\pi}} e^{-\frac{1}{2}t^2} dt \quad (54)$$

where

$$\alpha = \frac{\sigma_y^2 - 2rv\sigma_x\sigma_y + v^2\sigma_x^2}{\sigma_x^2\sigma_y^2}$$

$$\beta = -\frac{\sigma_y(r\bar{y}\sigma_x - \bar{x}\sigma_y) + v\sigma_x(r\bar{x}\sigma_y - \bar{y}\sigma_r)}{\sigma_x^2\sigma_y^2}$$

$$\varepsilon = \frac{(1-r^2)(v\bar{x} - \bar{y})^2}{\sigma_y^2 - 2rv\sigma_x\sigma_y + v^2\sigma_x^2} \quad \dots \quad (54 \text{ bis})$$

C_0 is so chosen as to make the total frequency unity. If \bar{x}/σ_x be large, Geary's approximation that

$$\frac{v\bar{x} - \bar{y}}{(\sigma_y^2 - 2rv\sigma_x\sigma_y + v^2\sigma_x^2)^{\frac{1}{2}}}$$

is distributed approximately normally with unit standard deviation, is deduced from Fieller's general result.

McKay (A 57) considers the distribution

$$y = y_0 e^{-cx/b} |x|^m \begin{cases} \pi I_m(x/b) \\ \text{or} \\ K_m(x/b) \end{cases} \quad \dots \quad (55)$$

where I_m and K_m are the Bessel functions of the second kind as defined by Watson. The upper function must be employed when $|c| > 1$, in which case the distribution curve extends from 0 to ∞ if c is positive and from 0 to $-\infty$ if c is negative. When $|c| < 1$ the lower function is to be employed, in which case the distribution curve extends from $-\infty$ to ∞ . The quantity b is a positive constant and $m + \frac{1}{2} > 0$. The semi-invariants of the distribution are obtained. Distributions of this form degenerate into Pearson Type III curves and into the normal curve for particular values of the parameters; the distribution of the first product-moment coefficient in samples of n drawn from an indefinitely large normal population and the distribution of the mean of samples of n drawn from an indefinitely large exponential population also belong to the family.

De Finetti considers the asymptotic behaviour of the frequency distribution of the greatest value in a sample (A 23). The subject was considered in a more general way by Fisher and Tippett (C 2) a few years ago, but De Finetti gives some useful tables.

(i) The ordinates of the frequency distribution of the maximum for normal samples of size 1, 2, 3 . . . 10 for values of the argument from -3.5 to 4 times the standard deviation of the original population at intervals of 0.1, to six decimal places.

(ii) The median value of the distribution of the maximum for samples of sizes 1-(1)-50; 50-(10)-500; 500-(100)-1000 and from 1000 to 900,000,000 for selected values respectively equal to 1, 1.2, 1.5, 2, 2.5, 3, 4, 5 . . . 9 multiplied by 10^3 , 10^4 , 10^5 , 10^6 , 10^7 , 10^8 .

He shows that if M_n be the maximum value in a normal sample

of n , ξ_n its median value, then the probability that $\xi_n | M_n - \xi_n |$ is less than ξ tends as n increases to the value

$$\Phi(\xi) = (\frac{1}{2})^{e^{-\xi}} \dots \dots \dots (56)$$

III. Orthogonal Polynomials.

The two most important papers on this subject in 1932, those of Aitken (A 2) and Jordan (A 51), have already been ably reviewed for this *Journal* by J. W. (Vol. XCVI, Part III, pp. 487-91). Reference may, however, be made to another paper of Aitken (A 1) on "The Orthogonal Polynomials in Frequencies of Type B." Charlier suggested a few years ago, and Aitken and Oppenheim rigorously proved, that certain well-known irregularities of convergence in the series of Type A might be obviated by expanding, not the frequency, but its logarithm in a series of Hermite polynomials. See (B 1), (B 3) and a review in this *Journal* (Vol. XCIII, pp. 118-20, 1930).

This is now shown to be true also of Type B; in fact it is shown that if $\log f(x)$ be expanded in the form

$$\log f(x) = \log \psi(x) + k_2 K_2(x) + k_3 K_3(x) + \dots \dots \dots (57)$$

where

$$K_r(x)\psi(x) = (-1)^r \nabla^r \psi(x)$$

$$\psi(x) = e^{-mx^2}/\Gamma(x+1)$$

$$\nabla \psi(x) = \psi(x) - \psi(x-1)$$

then the coefficient k_r is of the order N^{1-r} , where N is the number of causes of deviation or of elementary components. A numerical example of fitting (57) is given.

We must also refer to a paper by Greenleaf (A 35), who considers the problem of fitting polynomials in orthogonal form to numerical data, when there are an odd number $(2p+1)$ of observations which are weighted by the binomial coefficients of $(\frac{1}{2} + \frac{1}{2})^{2p}$. The problem in this form is not intrinsically important, but the author gives some reference to earlier papers on the subject, which may be added to those given in the previous two articles of this series. (See B (2)-(6) and (C 5) p. 577, (C 6) p. 509.)

IV. Theories of Statistical Inference.

Neyman and Pearson (A 60) have published an important paper "On the Problem of the Most Efficient Tests of Statistical Hypotheses." In their previous study of the theory of the testing of statistical hypotheses (C 8) Neyman and Pearson were perhaps the first to emphasize the distinction between the two sources of error which may arise:—

- (i) We may reject a hypothesis when it is true.
- (ii) We may accept it when it is false.

In point of fact all statistical tests may be regarded as tests for the rejection of hypotheses, so that the problem reduces to minimizing the error due to the acceptance of false hypotheses.

The hypotheses under consideration are of the type "A sample of n observations has been observed, it has been drawn from a certain specified population." The specification will be by means of a certain function of the measured variable, and a number of parameters, which, for fixed values of the variables, gives the probability of drawing a sample of given type. If all the parameters are supposed to have fixed values, *a priori* the hypothesis is termed simple, otherwise it is *composite*, when as a rule some of the parameters will have fixed values while the others are unspecified.

In the former case the likelihood of the assumed population may easily be written down, and also the likelihood of a population with any other set of values of the parameters. Hence we may find the set of parameters (*i.e.* the population) for which the likelihood is a maximum. The ratio

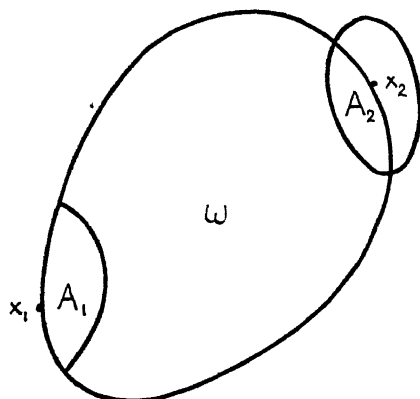
$$\frac{\text{likelihood of assumed population}}{\text{maximum likelihood}}$$

is termed by the authors the likelihood ratio. If we consider an n dimensional space determined by all the possible sets of sample values, there will be systems of contours in their space over which the likelihood ratio will be constant. The authors' criteria consists in finding the contour such that there is a given chance ϵ (say 5 per cent.) of the point which represents the sample falling outside it, if the hypothesis tested is true. In their earlier work they stated but did not prove that the choice of this system of contours maximized the chance of the sample being observed on any alternative hypothesis when the given hypothesis was rejected; *i.e.* *minimized* the source of error due to (ii). The proof is provided in the present paper.

The authors start with the notion of a *best critical region* for a given hypothesis with regard to an alternative. It is a region which gives a definite probability of rejecting the hypothesis under consideration and also maximizes the probability of accepting the alternative. By means of the calculus of variations they show that if p_0 is the likelihood of hypothesis, H_0 at any point of the sample space, p_1 the likelihood of an alternative H_1 , then, along the boundary of a best critical region, $p_0 = kp_1$. This may be shown without the calculus of variations (though less rigorously) as follows :—

Let ω be a region in which the chance of rejecting H_0 if true be ϵ , and in which the chance of accepting H_1 be a maximum. Let us call regions, in which the chance of rejecting H_0 is the same, equivalent regions. Take two points, X_1, X_2 on the boundary and sur-

round each by two small regions A_1 and A_2 (inside the boundary) in which the chance of rejecting H_0 , when it is true, is the same; if the chance of accepting H_1 is not the same in equivalent regions at X_1 and X_2 let it be greater at X_2 ; then by leaving out A_1 from the region ω and adding an equivalent region, originally outside the boundary, at X_2 , we should obtain a new boundary in which the chance of rejecting H_0 was still ε , but the chance of accepting H_1 was greater than before. This would contradict the hypothesis that the original boundary made the chance of accepting H_1 a maximum. Therefore, if a boundary is so chosen as to make the chance of accepting H_1 a maximum, the chance of accepting H_1 must be the same for all elementary regions close to the boundary which give the same chance of rejecting H_0 . That is, p_0/p_1 is constant on the boundary.



If the system of boundaries $p_0 = kp_i$ (k varying) is the same for all values of p_i , corresponding to different alternatives H_i , then clearly we arrive at the same system of contours as given by the constant likelihood ratio. If not, then there is no best critical region, but the authors suggest that a system of good critical regions may be found by obtaining the envelopes of the regions $p_0 = kp_i$ for the varying alternatives H_i , and these envelopes are shown to be identical with the contours of constant likelihood.

In cases where the hypothesis concerns the value of a single parameter, it is interesting to notice that the condition that there should be a best critical region reduces to the condition that the "statistic" used to estimate the parameters should be a sufficient statistic. For if T is a sufficient statistic for some parameter θ , and T' is any other estimate of θ , then the joint sampling distribution of T and T' may be written

$$f(\theta, T, T')dTdT' = \phi(\theta, T)\psi(T, T')dTdT' \quad . \quad (58)$$

and the likelihood of θ is then proportion to $\phi(\theta, T)$. Then if θ_0, θ_1 are two alternative hypotheses as to the value of θ , the likelihood ratio is

$$\frac{\phi(\theta_0, T)}{\phi(\theta_1, T)} = \lambda \text{ (say)}$$

$$\text{or } T = F(\theta_0, \theta_1, \lambda) \quad . \quad . \quad . \quad (59)$$

where F is some definite function.

Thus the contours along which T is constant are the contours of constant likelihood, and the substitution of another alternative θ_1 for θ_0 simply leads to another contour of the same system.

The authors go on to find conditions under which there will be best critical regions for testing *composite hypotheses* and show how to find them. Best critical regions must always satisfy the condition that the distribution of likelihood throughout them is identical with that throughout the sample space as a whole.

The theory is illustrated by a number of interesting examples. Among simple hypotheses these include testing whether the mean of a normal population with given variance has a specified value, and whether the variance of a normal population with given mean has a specified value. In the latter case the appropriate criterion turns out to be the second moment about the population mean, not the variance. Composite hypotheses involving one unspecified parameter include testing whether the mean of a normal population has a specified value, the variance being unspecified, which is found to lead to Student's solution; and testing whether the variance has a specified value, the mean being unspecified, which also leads to the ordinary test. Among composite hypotheses involving more than one unspecified parameter are the tests for the significance of the differences between two means and two variances—the theory leads to Fisher's well-known results.

Reference may also be made to an earlier paper by the same authors on "The problem of k samples" (C 9) in which they give criteria for testing (i) whether k samples come from normal populations identical both in mean and variance, (ii) whether they come from normal populations with the same variance, (iii) whether if they come from normal populations with the same variance, the means are also the same. The last turns out to be Fisher's "z" test.

The authors have recently restated their theory (A 61) discussing the relation of their tests to probabilities *a priori*, and showing under what circumstances and in what sense they will be independent of them.

Harold Jeffreys (A 48) gives a method for dealing with sets of observations, appreciable fractions of which are affected by abnormal

errors. The probability of an error is taken to be given jointly by two normal laws, one for the normal and the other for the abnormal errors, and a method of solution for the five unknowns is provided. An approximate solution may also be obtained by a method of weighting, the weight of an observation being a continuous function of its deviation.

Jeffreys' error function is taken as

$$f(x_r) = (1-m) \frac{h}{\sqrt{\pi}} e^{-h^2(x_r-x)^2} + \frac{mk}{\sqrt{\pi}} e^{-k^2(x_r-x-y)^2} \quad (60)$$

and his estimates of the two parameters x and y are obtained, when h, k, m , are already known, by assuming all values of x and y *a priori* equally likely, and maximizing the probability of the observed set of values. They are thus identical with the "maximum likelihood" values, but based on an "inverse probability" philosophy. Since he believes the inverse probability argument to be valid, Jeffreys goes further and obtains approximately the *a posteriori* distribution of the true value x about the estimated value x_0 .

When h, k, m, x, y are all unknown, the same method of estimation is used, but the *a priori* probabilities of h, k falling in the interval dh, dk , are taken as $\frac{dh}{h}, \frac{dk}{k}$ respectively.

The reason for this assumption is explained in a subsequent paper (A 49), but appeared to R. A. Fisher to be based on a somewhat subtle fallacy. The discussion on the point between Jeffreys and Fisher throws considerable light on the principles of statistical inference.

We have already had occasion to refer to Fisher's notion of "fiducial" probability statements in these articles ((C 6) p. 568). As an illustration of the principle, let us suppose we have a population with standard deviation σ and that from a sample of n' individuals we make an estimate of σ given by

$$s^2 = \frac{1}{n'-1} S(x - \bar{x})^2 \quad \dots \quad (61)$$

Then for a given form of distribution in the sampled population we may suppose the chance that s is less than X to be given by

$$\frac{u}{100} = \Phi\left(\frac{X}{\sigma}\right) \text{ where } \Phi(0) = 0 \quad \Phi(\infty) = 1. \quad (62)$$

If the sampled population is normal we know the form of Φ will be

$$\Phi\left(\frac{X}{\sigma}\right) = \frac{1}{\frac{n'-1}{2}} \int_{\xi=0}^{\xi=X} \left\{ \frac{(n'-1)\xi^2}{2\sigma^2} \right\}^{\frac{1}{2}(n'-1)-1} e^{-\frac{(n'-1)\xi^2}{2\sigma^2}} d\left\{ \frac{(n'-1)\xi^2}{2\sigma^2} \right\} \quad (63)$$

but we shall not require to use the formula explicitly.

Now let σ_0 be the value of σ which will satisfy the equation

$$\frac{u}{100} = \Phi\left(\frac{s}{\sigma_0}\right)$$

i.e. the value of σ for which the observed value would be the $(100-u)\%$ point.

Then in $u\%$ of samples

$$\begin{aligned} s &< \bar{X} \\ \frac{s}{\sigma} &< \frac{\bar{X}}{\sigma} \\ \text{or } \frac{\sigma}{s} &> \frac{\sigma}{\bar{X}} = \frac{\sigma_0}{s} \\ \text{or } \sigma &> \sigma_0 (64) \end{aligned}$$

Thus $\Phi\left(\frac{s}{\sigma_0}\right)$ is the chance that the true value will be greater than σ_0 , and in this sense we may speak of

$$-\frac{d}{d\sigma}\left\{\Phi\left(\frac{s}{\sigma}\right)\right\}d\sigma$$

as being the fiducial frequency distribution of the true value, and the inference is quite independent of any assumption about *a priori* probability.

Thus we have—

$$df = \Phi' \left(\frac{s}{\sigma} \right) \frac{ds}{\sigma} \text{ is the distribution of } s \text{ for given } \sigma$$

$$df = \Phi' \left(\frac{s}{\sigma} \right) \frac{s d\sigma}{\sigma^2} \text{ is the "fiducial distribution" of } \sigma \quad (65)$$

Now suppose we looked at the matter from an inverse probability standpoint. If we made Jeffreys' assumption that the *a priori* chance of a given σ is proportional to $\frac{d\sigma}{\sigma}$; the chance that this should be so and that a given value of s should be observed would be proportional to

$$\frac{d\sigma}{\sigma} \left\{ \Phi' \left(\frac{s}{\sigma} \right) \frac{ds}{\sigma} \right\} = \Phi' \left(\frac{s}{\sigma} \right) \frac{ds}{\sigma^2} \cdot d\sigma. \quad (66)$$

and we should conclude that the *a posteriori* distribution of σ would be

$$\Phi' \left(\frac{s}{\sigma} \right) \frac{sd\sigma}{\sigma^2}, \quad . \quad . \quad . \quad . \quad . \quad . \quad (67)$$

the s in the numerator of the latter expression being inserted to make the integral, over all values of σ , unity. Thus the fiducial and inverse

methods of inference would give the same numerical result but would have quite a different logical meaning.

This coincidence appeared to Fisher to be the basis of the fallacy in Jeffreys' argument. Jeffreys started with the postulate that if three independent observations are made from the same population the chance that the third one should be intermediate between the first two should be exactly $\frac{1}{3}$. He then proceeded to find the *a priori* distribution of h which would bring about this result for *each value* of the distance between the first pair of observations, on the assumption of the normality of the distribution of observations in the population sampled. But in point of fact we should not expect the result to be true for each value of the distance apart, but only for the average of all values. For, when we are dealing with a particular population, the chance of the third observation falling between the first two must be greater when they are far apart than when they are near together.

Fisher and Jeffreys agreed in finding that the chance that h should take a particular value, that the distance between the two first observations should be $2a$, and that the third will lie between them is

$$\frac{2hf(h)}{\sqrt{2\pi}} \operatorname{erf}(\sqrt{\frac{2}{3}}ha) e^{-2h^2a^2} dh da \quad . \quad . \quad . \quad (68)$$

and that the chance of the first two occurrences with no restriction on the third is

$$\frac{2hf(h)}{\sqrt{2\pi}} e^{-2h^2a^2} dh da \quad . \quad . \quad . \quad . \quad (69)$$

By integrating (68) and (69) for h from 0 to ∞ and equating the former to a third of the latter, for each value of a , Jeffreys found $f(h) = \frac{1}{h}$. But had he integrated each expression with regard to a from $-\infty$ to ∞ , he would have found (68) reduced to $\frac{1}{3}f(h)dh$ and (69) to $f(h)dh$. Fisher remarks, "The fact that the probability is one-third is assured, irrespective of h , and therefore for every frequency element of that variate independently. It is merely because the substitution $f(h) = \frac{1}{h}$ makes integration with respect to h equivalent to integration with respect to a , that the special distribution *a priori* satisfies Jeffreys' condition. . . . The apparent simplicity of the results of assuming this particular distribution *a priori* rests on the fact that the *inverse* and the *fiducial* probability statements about the *unknown* parameter are thereby made to coincide, though logically they are entirely distinct."

Jeffreys subsequently replied to Fisher's criticisms maintaining his position (A 50), and the different view-points of the two writers have been clearly compared in a paper by Bartlett (A 4).

Bartlett points out that the validity of Jeffreys' result depends on the truth of the equation

$$P(\{x_3\}/x_1, x_2, f, d) = \frac{1}{3}P([x_3]/x_1, x_2, f, d) \quad . \quad (70)$$

where $\{x_3\}$ denotes the fact that x_3 lies in the interval (x_1, x_2) , $[x_3]$ that it lies in the entire range $(-\infty, \infty)$. The left-hand side of the equation means the probability of $\{x_3\}$ given x_1, x_2, f and d . f is the fact that x is normally distributed about the unknown true value and d is our relevant *a priori* knowledge. If we are in complete ignorance of the range of error, this equation is possibly true as a statement of subjective probability, though we think it makes inadmissible use of the principle of non-sufficient reason. The point, however, is not as important as it otherwise might have been because Jeffreys has given a more convincing proof (A 50) that if the prior probability of h is a continuous function it must be proportional to $\frac{dh}{h}$.

He first points out that the distribution $f(h)dh$ of prior probability cannot involve any quantity other than h ; for if it involved some quantity a of the same dimensions as h , we could determine the prior probability that h is less than a , namely,

$$\int_0^a f(h)dh / \int_0^\infty f(h)dh,$$

which is inconsistent with complete previous ignorance of the value of h . Secondly, since h is a measurable quantity, not a pure number, the only significant functions of h not involving other quantities of its own dimensions are powers of h , e.g. e^{-h} means nothing if $\frac{1}{h}$ is a length. Thus the ratio of the probabilities that h is less and greater than h_0 is

$$\int_0^{h_0} h^n dh / \int_{h_0}^\infty h^n dh.$$

If $n > -1$, this is zero for all values of h and it is certain that h is infinite; if $n < -1$ it is infinite for all values of h , and it is certain that h is zero. But with $n = -1$, the integrals diverge at both limits and their ratio is indeterminate.

"It is in this case, and only in this, that the distribution of probability tells us nothing as to the probability that h will exceed any definite value; and for this reason alone it must be the correct

distribution when we have no previous knowledge of h ." However, Jeffreys does not point out that this distribution has the disadvantage that it gives zero probability of a value of h between any two finite limits; and, if we are in complete ignorance of the *a priori* distribution of h , what valid reason is there for it to be a continuous function? If, on the other hand, we postulate a continuous function for the *a priori* distribution, we would rather take our stand, were we concerned to justify the use of inverse probability in such cases, on the fact that, in large samples at any rate, it makes little difference what particular function be postulated.

V. *Mathematical Epidemiology.*

Kermack and McKendrick (A 52) consider the following problem:—"Given a community in which there are a certain number of cases of a particular disease already present and into which new individuals, previously unattacked, are introduced; to determine the conditions for a stationary state and the sequence of events following a small disturbance of the stationary state. Two important limitations are attached to the cases considered. The effect of the chronological age of the individuals is not taken into account at all. Other things being equal, individuals are assumed to have the same susceptibility, the same infectivity and the same chance of dying or recovering whatever their age. Secondly, it is supposed that all deaths are due to the single disease which is operative, and no removals from the community take place by any other mechanism.

The community at any time will consist of a number of (1) susceptibles unattacked previously, or *virgins* (\bar{x}), (2) susceptibles who have been attacked previously and have recovered (x), (3) those sick (y). Entrance into the community will be by immigration or birth, exits by death. In the first section the rates of death and recovery (\bar{d} and l) are considered constant and independent of the stage of the illness; the chance of infection of a particular virgin is considered proportional to the number of sick at the time, $\bar{k}y$ say, where y are the number of sick, while the chance of infection of a recovered person is ky . \bar{k} and k are supposed constant. \bar{x} , x , y may be taken as referring to unit areas, so that they represent population densities. The immigration rate is m , $\bar{\mu}$, μ and ν are the birth-rates among unattacked susceptibles, recovered cases and sick respectively. The rate at which new individuals accrue is \bar{u} , the rate at which individuals pass into the recovered group is u , the rate at which virgins turn ill is \bar{v} , the rate at which the recovered turn ill is \bar{v} , and $v = \bar{v} + \bar{v}$ measures the incidence of the disease; $w = dy$ measures the deaths.

With this notation the following equations are easily found :—

$$\begin{aligned}\frac{d\bar{x}}{dt} &= u - \bar{v} = m + \bar{\mu}\bar{x} + \mu x + \nu y - \bar{k}\bar{x}y \\ \frac{dx}{dt} &= u - \bar{v} = ly - kxy \\ \frac{dy}{dt} &= v - w - u = \bar{k}\bar{x}y + kxy - dy - ly \quad . \quad . \quad (71)\end{aligned}$$

and the conditions for a steady state are

$$\frac{d\bar{x}}{dt} = \frac{dx}{dt} = \frac{dy}{dt} = 0 \quad . \quad . \quad . \quad (72)$$

These and the other relations which necessarily hold between the variables in virtue of their definitions, are sufficient to determine the values of \bar{x} , x , y , \bar{u} , u , \bar{v} , v , w , consistent with a steady state. If a small disturbance is then introduced, it is found by the authors that either damped vibrations ensue, or an aperiodic return towards the steady state.

By giving m , $\bar{\mu}$, μ , ν , d , l particular values, for instance making certain of them equal and the others zero, a number of interesting cases can be discussed. The only exception to the statement that steady states are also stable states occurs when $m = 0$, $\bar{\mu} = \mu$, $\nu = 0$, $l = 0$, i.e. the exceptional case of a closed community in which the sick do not reproduce and there are no recoveries, here simple harmonic oscillations may occur.

The authors next consider the more difficult case when the death-rate and the recovery rate depend on the duration (θ) of the illness, as does also the chance of a virgin being infected by an infected individual who has been ill for a time θ , (k_θ), whilst a recovered individual who has been recovered for a time τ is assumed to have the chance $k(\tau, \theta) = \omega_\tau \phi_\theta$ of being infected by a person who has been ill for time θ . Their most important conclusion is that if a certain quantity, $D - \nu N - \mu L \varepsilon$ is negative, no steady state exists, and that a unique steady state exists if it is positive.

$$\begin{aligned}\text{Here} \quad D &= \int_0^\infty D_\theta d\theta \quad N = \int_0^\infty N_\theta d\theta \quad L = \int_0^\infty L_\theta d\theta \\ D_\theta &= d_\theta N_\theta \quad L_\theta = l_\theta N_\theta \quad N_\theta = e^{-\int_0^\theta (l_{\theta'} + d_{\theta'}) d\theta'} \quad . \quad . \quad (73)\end{aligned}$$

and ε is the time during which immunity is absolute. If the unique steady state does exist, the corresponding attack rate (V) is given by the root of the equation

$$DV = m + \bar{\mu} \frac{D}{K} + \mu LVF(V) + \nu NV \quad . \quad . \quad (74)$$

where in addition to the symbols already defined

$$\begin{aligned}\bar{K} &= \int_0^\infty \bar{K}_\theta d\theta = \int_0^\infty \bar{k}_\theta N_\theta d\theta \\ F(V) &= \int_0^\infty e^{-\Phi} \int_0^{\omega \xi d_\xi} d\tau \\ \Phi &= \int_0^\infty \Phi(\theta) d\theta = \int_0^\infty \phi_\theta N_\theta d\theta \quad . \quad . \quad . \quad (75)\end{aligned}$$

The remaining quantities specifying the steady state are then easily expressed in terms of V .

The authors also give equations specifying the state at time t when a small disturbance is introduced into the steady state at time $-T$, but have not so far succeeded in solving them.

Another interesting conclusion is that an increase of the immigration or birth-rate results in an increase both absolute and relative of the incidence of fresh cases. It will also result in an increase of the mortality rate and the endemic level. It would be interesting to have the theory applied to some actual or experimental populations, but it is not easy to see how to determine from numerical data quantities which the theory postulates to be known.

VI. Other Investigations.

Professor Karl Pearson continues his study of the frequency distribution of rank variates and rank intervals (A 65). The first part, mentioned in our last article, dealt with normal and rectangular populations; the present part deals with exponential populations and the other J -frequency distributions of the Pearsonian scheme whose values of β_1, β_2 lie on the biquadratic

$$\begin{aligned}\beta_1(8\beta_2 - 9\beta_1 - 12)(\beta_2 + 3)^2 \\ - (10\beta_2 - 12\beta_1 - 18)^2(4\beta_2 - 3\beta_1) = 0 \quad . \quad . \quad (76)\end{aligned}$$

The exact forms of the frequency distributions of the rank variates are obtained. The moments of rank variates and rank intervals in the exponential case are shown to depend on the successive differential coefficients of the logarithm of the beta-function $B(q, n - q + 1)$. These functions are expressible as the sums of inverse powers, which fact makes the mathematics arithmetically workable. For this purpose Pearson publishes a table of $S\left(\frac{1}{n}\right)$ and $S\left(\frac{1}{n^2}\right)$ to twelve decimal places from $n = 1$ to $n = 100$ which may also be useful for other purposes.

As we should expect from Professor Pearson, the theory is illustrated numerically in the fullest possible manner by the con-

sideration of samples of eleven from populations of the various types involved. The author's main conclusions are that—

(a) The correlation between adjacent rank variates is high, but the correlation between adjacent and, *a fortiori*, non-adjacent rank intervals is small, for many purposes negligible.

(b) The partial correlation of any two rank-variates, or any two rank-intervals for a constant rank-variate or a constant rank-interval lying between them is zero.

(c) The order of the variabilities of rank-intervals as measured by their standard-deviations is much the same as the order of the intervals themselves. There is equality in the case of the exponential curve, and this property extends approximately for a considerable range on either side of it.

(d) Galton's ratio, namely 2 to 1, for the ratio of the first rank-interval to the second, in the case of the end of the curve with lesser frequency, is approximately true for a large number of curves.

(e) In samples from a curve of finite range the correlations of adjacent inter-rank intervals are negative; in samples of one with unlimited range they are positive.

(f) In the case where there is much predominance of mediocrity, the interval between the first and second ranks may be ten or more times the interval between mediocre individuals. This is but a special illustration of the great principle (which ought to be generally recognized but frequently is not) that differences in physical or mental ability between specially able individuals will invariably be found to be much greater than between ordinary individuals. Several characteristics of the so-called "genius" are involved in this principle.

Professor Pearson finds the justification for this detailed treatment of the problem for a particular class of frequency distributions in the fact that this class of distributions will give the frequency of space or time intervals between events occurring at random when we cannot suppose an event to happen at a point of space or time, but must consider whether it happened or not in the smallest interval we can measure. The exponential distribution, of course, comes into the system as a limiting case.

Frisch (A 30) studies discrete frequency distributions from rather a novel point of view. If $f(x)$ be a finite frequency function given in the enumerable set of points $x = 0, \pm 1, \pm 2, \dots \pm \infty$; for any given $f(x)$, it is always possible to indicate a set of numbers P_x and Q_x such that the equation

$$P_x f_x + Q_{x+1} f_{x+1} = 0 \quad . \quad . \quad . \quad (77)$$

holds good identically in x . The principal characteristics of the

frequency distribution are determined by the numbers P and Q . If f_x be a frequency distribution satisfying (77) and a be a given real number, then a solution H_x of

$$P_x H_{x+1} + a Q_{x+1} H_x = 0 \quad . \quad . \quad . \quad (78)$$

is called a *characteristic multiplier* for the frequency distribution f_x , belonging to the characteristic number a . More generally if H_{0x} , H_{1x} . . . H_{nx} be a set of functions such that

$$P_x H_{n, x+1} + Q_{x+1} \sum_{v=0}^n a_{nv} H_{v, x} = 0 \quad . \quad . \quad . \quad (79)$$

where a_{nv} is a set of real numbers, such a set of functions is called a *set of characteristic multipliers* for the frequency distribution $f(x)$, and the set is said to belong to the characteristic numbers $a_{n, v}$.

These ideas are of importance in the theory and calculation of incomplete moments; for instance, if

$$M_v(t, \omega) = \sum_{x=t}^{\omega} H_{v, x} f(x) \quad . \quad . \quad . \quad (80)$$

we may derive the recurrence relation

$$(1 - a_{nn})M_n(t, \omega) = H_{n, t} f_t - H_{n, \omega+1} f_{\omega+1} \sum_{v=0}^{n-1} a_{nv} M_v(t, \omega) \quad (81)$$

satisfied by the incomplete moments taken over the characteristic multipliers of any frequency distribution.

If $\sum_{x=t}^{\omega} H_{v, x} f_x$ is convergent we may write

$$M_{v, t} = \sum_{x=t}^{\omega} H_{v, x} f_x$$

and obtain

$$(1 - a_{nn})M_{n, t} = H_{n, t} f_t + \sum_{v=0}^{n-1} a_{nv} M_{v, t} \quad . \quad . \quad (82)$$

For example, if we take the point binomial

$$f_x = \binom{s}{x} p^x q^{s-x} \quad q = 1 - p$$

and

$$P_x = p(x - s), \quad Q_x = qx, \quad H_{v, x} = x^v \quad . \quad . \quad (83)$$

we may derive the formula

$$M_{n, t} = q H_{n, t} f_t + p \sum_{v=0}^{n-1} \left\{ s \binom{n-1}{v} - \binom{n-1}{v-1} \right\} M_{v, t} \quad . \quad (84)$$

This method also lends itself to the calculation of criteria for determining whether numerical frequency distributions conform to an assumed type or not, and may be generalized so as to apply to continuous as well as discrete frequency distributions.

Tippett (A 81) gives "a modified method of counting particles" which may be of considerable practical value. The technique

described is devised to meet the case when the distribution of zones containing 0, 1, 2, 3 . . . particles is of Poisson form, but it is difficult to count zones containing more than three or four particles. This is the position when "snap" readings are taken of a large number of small microscopic fields.

The data thus take the form of the frequencies of zones containing 0, 1, 2 . . . t , more than t particles. The maximum likelihood solution for the Poisson parameter under these conditions is obtained and a nomogram is given for its use when frequencies with respectively more than one, two and three particles are combined.

If $n_0, n_1, n_2 \dots n_t, n_r$ denote the proportional frequencies of zones containing 0, 1, 2, . . . t more than t particles, respectively, and

$$n_p = \sum_{s=0}^t n_s \quad m' n_p = \sum_{s=0}^t s n_s$$

the maximum likelihood solution (\hat{m}) is given by the equation

$$m' n_p = \hat{m} \left(n_p - n_r \frac{\hat{n}_t}{\hat{n}_r} \right) \quad . \quad . \quad . \quad (85)$$

where \hat{n}_t and \hat{n}_r are the corresponding frequencies calculated from the Poisson series with parameter \hat{m} . The standard error is given approximately by

$$\frac{\mu^2}{\sigma_{\hat{m}}^2} = \mu v_p - \mu^2 v_{t-1} + \mu v_t \left(\mu \frac{v_r + v_t}{v_r} - 1 \right) \quad . \quad . \quad (86)$$

where the v 's are true proportional frequencies and μ is the true mean number of particles.

The author shows, for example, that with a density of 4.2 particles per zone, 100 zones, when all the particles are counted, give the same accuracy as 140 counted by the modified method when $t = 3$, and the latter process may then be quicker than the former.

"When (with $t = 0$) the true mean (μ) is 1.6, the standard error of the mean so estimated (expressed as a ratio of the mean) is only 1.24, and this is less than the corresponding standard error for $\mu = 0.5$ when all particles are counted, that is the accuracy of the modified method with $t = 0$ is greater than that with which many ultra-microscopists have to be satisfied."

In conclusion, it must once more be emphasized that it has only been possible to discuss a selection of papers, that the reviewer has chosen those with which he felt more competent to deal; as an example of papers to which he has not been able to do justice may be mentioned two on curves of concentration (A 34 and A 70). It is hoped that, with collaboration, in future a wider field may be covered.

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INDIAN AGRICULTURAL STATISTICS.

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Historical.

THERE was no systematic collection of agricultural statistics in India before 1882, when a beginning was made at the instance of the Secretary of State, who forwarded a set of tables compiled in the India Office for use in India. The enquiry made at the time by the Government of India revealed lack of uniformity in the nature and method of collection of Statistics, which loudly called for standardization. A series of Statistical Conferences and Committees met and drew up a set of forms for the collection of data, which are in use even to-day with a few modifications.

"Agricultural Statistics of India."

At the present time, all important data are published in *Agricultural Statistics of India*, the first volume being devoted to British India and the second to the Indian States. The latter is incomplete and somewhat less accurate. About half the area and population of the States are not represented. Even all the States which send returns have no adequate statistical organizations. Only the progressive and more important States such as Hyderabad, Baroda and Mysore have the necessary staff. But the nature, form and contents of Vol. II are substantially the same as those for Vol. I—only the harvest prices are not given in Vol. II.

Details of Statistics available.

Vol. I has seven Tables as stated below:—

Table I for total area by provinces;

„ II for classification of area as cultivated, uncultivated, etc.;

„ III for irrigation divided into two parts: (a) total area irrigated from different sources such as tanks, canals, wells, etc., and (b) the areas under different crops irrigated;*

„ IV for area under each crop, under double cropping and the net area sown;

„ V for live-stock, ploughs and carts;

„ VI for land revenue and assessment of land revenue;

„ VII for harvest prices.

Anomalies in the above Tables.

In Table I, the area according to village papers is accepted for agricultural purposes, but it does not tally with the area according

* The total of (a) does not, however, agree with that of (b) on account of double cropping.

to the Indian Survey Department, the latter in some cases including, but in others excluding, rivers, canals, railways, etc. For the year 1930-31 the total area of British India comes to 667.5 million acres according to village papers, but 669.3 million acres according to the Survey Department. In Table II, the area shown as forest does not agree with the forest area as given in the Forest Department Administration Report, for the latter includes *all* land administered by the Department, although a part of it may have been cleared up and put under cultivation. Another reason for this discrepancy is that forest areas administered by district officers are also included in Agricultural Statistics. A third and a minor reason is that the Agricultural Statistics are for agricultural years July to June, whereas the Forest Administration's Reports are for financial years April to March. The picture shown by Table VI of the incidence of land revenue is rather distorted, for it gives, not the rent actually paid by cultivators, but the revenue due to Government, which is much less than the former.

Agency of Collection.

There is no separate agency for collecting these statistics. The revenue staff is utilized for this purpose, except in permanently settled tracts, where no such staff is maintained. While this ensures economy, it also leads to a serious difficulty, for statistical considerations have to be subordinated to revenue needs. This has entailed lack of uniformity, as revenue requirements are different in different provinces. Two examples will make this clear. In some parts of India, such as the Punjab, if land is not taken up for cultivation for more than two consecutive years it is classed as unculturable, whereas in Bombay ten years must elapse before this may be done. Thus the areas for current fallows and unculturable wastes are of doubtful statistical accuracy. No valid inference may be drawn about the pressure of population merely from a study of changes in unculturable wastes, other than fallows, for the proportion of unculturable wastes to total area has remained practically the same in spite of the recent considerable increase in population.

Another example is provided by "mixed" crops. In the United Provinces oil seeds are grown largely as companion crops with food grains such as wheat, barley, etc. But in the form prescribed for the *patwari* or the village accountant there is no heading for unimportant "mixed" crops. Thus the areas for companion crops are credited to the area for the principal crop, which is correspondingly inflated. Thus from Table IV of *Agricultural Statistics*, Vol. I, the United Provinces does not appear to be an important tract for oil seeds. A correct picture is afforded by the *Estimate of*

Area and Yield of Principal Crops in India, which gives the areas for "mixed" crops separately.

Estimate of Area and Yield.

Curiously enough, the total out-turn figures are not available in either of the two volumes of *Agricultural Statistics*. Only in an Appendix to Vol. I, the normal yields per acre of different crops are given. The total out-turn figures are available in the *Estimate of Area and Yield*, but the area figures there do not tally with those in *Agricultural Statistics*. Several States have no requisite staff for supplying all the information required for the latter. They only send reports about their more important crops, which are included in the all-India forecasts and thus find their place in the *Estimate of Area and Yield*, which is in effect a summary of all forecasts. Even for British Indian provinces where this difficulty is not present there is sometimes a discrepancy between the area figures for the same crop in *Agricultural Statistics* and *Estimate of Area and Yield*. This was clearly pointed out by the Indian Sugar Committee of 1920 (on p. 362 of their report). Recently the Royal Commission on Agriculture has made a recommendation about reconciling discrepancies in different departmental publications.

Forecasts.

All-India forecasts are issued for the following crops:—rice, wheat, cotton, jute, sugar-cane, linseed, rape and mustard, ground-nut, sesamum and castor.* Besides these, the total out-turn of some crops such as barley, *jowar*, bajra, gram, maize and tobacco is collected annually and published in Subsidiary Tables in *Estimate of Area and Yield*. For planters' crops, viz. tea, coffee and rubber, the information is collected from the plantations direct on the understanding that the figures for individual gardens will not be disclosed in any way. These figures are stated to be checked with the information obtained from the Indian Tea Association and the United Planters' Association of Southern India. Special reports are issued annually for each of these crops, the summary figures being included in the *Estimate of Area and Yield*.

Generally speaking, three forecasts are published, there being an additional forecast for important crops like cotton and wheat. Each of these serves a distinct purpose. The first is designed to give as early as possible information regarding the area sown, the germination of the seed and the effect of weather conditions on seedlings. The second, issued about two months later, includes areas of late sowings and gives an indication about the probable

* The forecast for indigo has now been discontinued as recommended by the Royal Commission on Agriculture.

yield expressed as a percentage of the normal or standard out-turn. The third and the final forecasts show the total area and the total yield either harvested or expected to be harvested for early and late varieties. Thus the element of prediction, which is the chief characteristic of a forecast, is not emphasized at all. To give an illustration, the first forecast for cotton shows areas only under early varieties with no indication as to what the final acreage would be. The second forecast includes late sowings only up to the time of its issue. Not only this, a careful perusal of the forecasts will show that the information given often relates to conditions nearly a month old. Thus in the case of cotton the first forecast, which is issued in the third week of August, reports conditions current generally about the end of July. There seems to be scope for improvement in this respect, seeing that in U.S.A. the forecast issued about the 8th or 9th of a month reports conditions as on the 1st of that month.

Area.

As stated above, the revenue agency report area figures, which are extremely accurate. Only in permanently settled tracts these figures are conjectural. Unfortunately in the case of jute, the area falls almost entirely within the permanently settled tracts, and the acreage is correspondingly inaccurate. Another source of error is the existence of "mixed crops," which has already been referred to. But although the area figures are otherwise correct, there is scope for improvement in this respect also. For, it is only when the village accounts are finally checked and adjusted that the correct figures are available. The areas reported during the growing season in connection with the forecasts reveal discrepancies, when compared with the finally adjusted figures available at the end of the season. For purposes of illustration, the following figures may be quoted :—

Area under Cotton in India.

(In acres.)

	1st Fore- cast.* August.	2nd Fore- cast.† October.	3rd Fore- cast. December.	4th Fore- cast. February.	Finally adjusted figures.	
					Unrevised.	Revised.
1927-28 ...	15,231	20,592	23,178	23,812	24,722	24,761
1928-29 ...	15,196	21,700	24,992	25,874	26,484	27,053
1929-30 ...	15,885	20,812	23,536	25,121	25,692	25,922
1930-31 ...	14,875	20,506	22,964	23,531	23,616	23,812
1931-32 ...	13,926	19,654	22,358	23,511	23,522	23,722

* Deals exclusively with early variety.

† Early variety and part of late variety. The remaining forecasts deal with both early and late varieties.

The area reported in every case is the area sown—not the area harvested as in some other countries. Any comparison between the yield per acre in India and abroad should take this fact into consideration. The following statement* given in Table IV of *Agricultural Statistics* may be noted in this connection:—

“This table shows the area *actually sown*, whether the crops come to maturity or not, except in cases where fields owing to failure of first sowings have been devoted to other crops; in such cases the area first sown is omitted.”

Yield.

In India the yield is not directly ascertained, but is estimated on the basis of a standard or normal yield and of the relation which the particular year bears to the normal. The first is known as the normal out-turn and the latter as the seasonal or condition factor. The basis of the former in India is crop-cutting experiments, which are conducted every year. The results of these experiments are reported to the provincial heads of agriculture or Directors of Land Records at the end of every five years, who on a careful scrutiny of the results and such other outside evidence as is available verifies or revises the standards. But a perusal of the *Quinquennial Report on the Average Yield per Acre of Principal Crops in India*, which gives the results of crop-cutting experiments, shows that these are meagre and the results are unreliable. To give an illustration, for an important commodity like jute, only the following experiments were made:—

District.	Normal Area under Jute.	No. of crop-cutting experiments in Jute.				
		1927-28.	1928-29.	1929-30.	1930-31.	1931-32.
Mymensing ...	538,000 acres	6	21	14	29	16
Dacca ...	253,000 „	15	17	8	59	31
Faridpur ...	212,000 „	18	17	16	31	18

There is thus a considerable scope for improvement in this respect.

Condition Factor.†

This is purely subjective. It is found that a normal condition is rarely reported. Any report in excess of the normal is con-

* P. 116 of Vol. I for 1930-31.

† This refers to the area sown and not to the area harvested, as all calculations are on the basis of the area sown. Hence no estimate of the acreage omitted from harvest is necessary. Thus if in a field covering two acres, the crop on one acre is totally destroyed and that on the other bears a full yield, the condition factor is shown as 50 per cent. of the normal. Obviously this makes no difference so far as the total produce is concerned, but the yield per acre is affected. Failure to note this gives rise to misconceptions (*vide* third line under Acreage of Mr. Vaidyanathan's article in *Agriculture and Live Stock in India*, Vol. II, Part I, January 1932).

spicuously absent. This shows that Indian *patwaris*, like crop reporters elsewhere, are unduly pessimistic; they confuse normal with an ideal or a bumper crop; they forget that even a normal crop must have its normal share of vicissitudes.

Suggested Improvements.

These defects in the crop reporting system were discussed by the Board of Agriculture in 1919 and again in 1924, and opinion was unanimous that the crop-cutting experiments must be made on a much more liberal scale so as to yield correct standards. As regards the condition factor, it was suggested that no useful purpose would be served by teaching the *patwaris* the correct significance of the term "normal." They should rather be allowed to follow their traditional method, but that their reports should be interpreted in the light of past experience. Thus on the suggestion of Mr. G. A. D. Stuart, late Director of Agriculture, Madras, it was proposed that a correction should be applied to the raw condition figure reported by the *patwaris*. The method of correction suggested is this: Suppose that during the last ten years the *patwaris* reported the following condition figures: 60, 70, 80, 40, 30, 45, 75, 85, 35, 50 whose average is 57. If, therefore, they report a condition of 60 per cent., the corrected or adjusted condition would be $\frac{60 \times 100}{57}$.

This is, of course, based on the idea that a period of ten years is a long enough period to eliminate year-to-year fluctuations. This is evidently a very rough method of correction. For the "normal" does not necessarily correspond with arithmetic average of the figures for a series of years which is hypothetical and has no objective reality. From the statistical standpoint the modal average is suggested, and this is also corroborated by the official definition of the normal crops as "that crop which recurs most in a series of years." Another drawback of Stuart's method is that it assumes that the same error is made by the *patwaris* throughout the range, but owing to ingrained pessimism, it is likely that the error is great in the case of comparatively bad years. Then again, owing to the peculiar revenue system of the country according to which cultivators are granted partial or full remission of revenue if the crop does not exceed a certain percentage of the normal, the chances are that the condition figures would be scrutinized more carefully near the exemption limit than at any other point of the range. It seems, therefore, that a rough-and-ready method of correction cannot meet the situation and that a detailed statistical study of the reported condition figures over a large number of years is necessary to deter-

mine the mode correctly. The need for application of statistical methods also arises in connection with the supervision and technique of crop-cutting experiments. And though this fact was recognised as early as 1919 when the Board of Agriculture recommended the appointment of a statistical assistant under each provincial Director of Agriculture, no steps were taken to follow up the above recommendation. Accordingly, when the Royal Commission on Agriculture reviewed the position about ten years later, they deplored that in none of the provinces excepting Madras was there a statistical assistant to deal with this important subject. They recommended, therefore, that such assistants should be appointed without delay to take charge of the work, but the recommendation still remains a pious wish. The Royal Commission on Agriculture rightly observed that the whole outlook in regard to statistical matters urgently required broadening.

Possible Objective Studies.

The official systems of crop forecasting in other countries are also based on the subjective method. But to avoid some of the dangers that are inherent, objective methods of study are made at least to have an indirect check on the results secured by the usual subjective methods. Such objective studies may be the determination of yield from antecedent weather conditions by statistical methods or the correlation between prices and subsequent acreage. So far as the writer is aware, Jacob was the first to work in this line in India. Then followed Unakar, who studied the relation between weather conditions and acreage and yield of the wheat crops in the Punjab. Recently other workers are devoting their attention to this work, and some of the studies so far made are described below :—

- (1) "Yield of Rice in South Canara," by Prof. Adyanthaya of Madras University.
- (2) "Indian Cultivators' response to Prices," by the present author jointly with two others.

It is understood that some time ago a grant was made by the Imperial Council of Agricultural Research for the study of agricultural meteorology, but the writer has not so far seen any studies on the subject.

The difficulties of carrying out objective studies in the relation of weather to yields are very great in India. Most of the studies described above, such as those of Unakar, Adyanthaya, etc., suffer from the fact that they used official figures of yield which are known to be inaccurate. It was overlooked that statistical methods are

a tool which can yield useful results only when applied to proper data. So far as yields are concerned, reliable records extending over a fairly long series of years are practically impossible to get, and the application of refined statistical studies which is a usual feature in other countries has somewhat limited scope in India. Even on the side of area figures on which the statistical worker is well served, there is a danger. Owing to the gradual development of the crop reporting system in India, new areas have from time to time been included in the scope of the returns. Consequently the variation in area figures over two periods widely apart may not reflect the time rate of increase or decrease. A great deal of care and caution is therefore necessary in handling these statistics, and prospective workers would do well to learn the genesis of these statistics before they begin to work with these data.

Independent Checks.

Besides the statistical methods, there are other independent checks to crop production data. This is by means of trade and consumption statistics. Though the former is accurately known, the difficulty arises in connection with the latter, particularly in the case of articles of human food. In such cases, the method is not workable owing to lack of reliable consumption statistics. In the case of commercial crops like cotton and jute, a major portion of which is consumed in mills, the position is obscured by lack of accurate data for local or extra-mill consumption and carry-over from season to season. Difficulties regarding the stock can no doubt be got over by taking the average of a series of years. But such figures can indicate only in a general way the error in the production figures. There is no means of knowing the error in particular years. A comparison of the ten-yearly moving averages of final forecasts of cotton and jute with those disclosed by trade and consumption statistics reveals that the forecasts are generally under-estimated. But the figures for individual years cannot be accurately determined by this method.

REVIEWS OF STATISTICAL AND ECONOMIC BOOKS.

CONTENTS.

	PAGE		PAGE
1.—New Survey of London Life and Labour, Vol. V. London Industries, II.	163	8.—Durbin (E. F. M.). Purchasing Power and Trade Depression	175
2.—Warren (G. F.) and Pearson (F. A.). Prices	165	9.—Sinha (H.). Early European Banking in India ...	177
3.—Royal Institute of International Affairs. Monetary Policy and the Depression ...	166	10.—Florence (P. Sargent). Logic of Industrial Organization.	178
4.—Gluckstadt (H.). Theory of the Credit Standard. Mechanism of the Credit Standard ...	168	—Urwick (L.). Management of To-morrow	178
5.—Zolotas (X.). L'Étalon-Or, en Théorie et en Pratique ...	169	11.—Walker (E. R.). Australia in the World Depression ...	180
6.—Rist (C.). Essais sur quelques Problèmes Économiques et Monétaires	170	12.—Fenn (J. A.). Foundations of Agricultural Economics ...	182
7.—Pigou (A. C.). Theory of Unemployment	172	13.—Dublin (L. I.). To Be or Not To Be. A Study of Suicide	183
		14.—Other New Publications ...	185

1.—*The New Survey of London Life and Labour*. Vol. V. London Industries, II. London: P. S. King, 1933. 8 $\frac{3}{4}$ " \times 5 $\frac{1}{4}$ "; xii + 435 pp. 17s. 6d.

In *The New Survey of London Life and Labour* the original intention was to devote two volumes to the description and analysis of the conditions under which Londoners work; this compression of the material has proved to be impossible without the exclusion of much valuable data or the expansion of the volumes to an unwieldy size. The first account of London's industries (Vol. II of the series) dealt with rather more than one-third of the total insured workers together with the great uninsured industry of private domestic service: the present volume extends the account to another million occupied persons or 40 per cent. of the estimated occupied population of Greater London (i.e. somewhat more than one-third of the insured workers and a considerable margin outside unemployment insurance). A third and additional volume is promised to deal with the large number of industrial and commercial workers (e.g. clerical occupations, catering trades, gas, water and electricity services) for which space has been lacking. Even then a number of minor trades and the whole range of professional occupations must remain undiscussed. In making the necessary selections priority has, however, been given to the industries and occupations which are most closely bound up with the life and labour of the great mass of the London population.

The present volume deals with food, drink and tobacco manu-

tecture, wholesale food markets, retail shops and shop assistants, chemical and allied industries, printing and bookbinding, leather and fur industries, the laundry trade, and water transport. A clear and very readable account is given of each of these industries or occupations and their development since the days of Charles Booth, as regards organization, mechanization, hours of work, wages, amenities, and many other factors. Apart from these, in general, more important aspects the investigators also provide many interesting little sidelights on the industries surveyed. For instance, "for dealing with the problem of unemployment there exists in the Jewish baking industry a unique system of 'jobbing' organized by the trade union, which takes the place of unemployment benefit paid by other unions. By this system each member is compelled to stay away from work at regular intervals of, say, once a month, and his place is taken by an unemployed member. Thus every unemployed member has one or two jobs every week." The difficulties of making a true occupational classification, *e.g.* for mortality statistics, are illustrated in mass-production bakeries, where it is observed that all employees call themselves *bakers*, but that in such a factory it is possible to work without any of the men, saving the foreman in the mixing department and the foreman in charge of the plant itself, knowing anything about baking. For the most part the employees are, in fact, skilled machine-minders, and ex-naval stokers are said to make excellent "bakers"!

Various unexpected "biological" relationships are revealed, for instance that "with the supersession of small cabinet makers, whose workshops were in Bethnal Green, by large-scale manufacturers, the fish curing trade—which depends on supplies of sawdust—is said to have moved to ports such as Hull, where fish and timber are found in proximity:" while "North Kensington and Acton were classic homes of the laundry trade, largely because of their proximity to the brickfields. It was the ambition of the brickmaker to marry an ironer, whose earnings could maintain the home during the winter when the brick fields were slack." Such aspects as these are, perhaps, only minor points in London's life and growth, but they are none the less interesting for that—indeed, Londoners who find little or no intellectual satisfaction in the statistical analysis of wage rates or of hours of labour will find a great deal in this and the previous volume, which cannot fail to interest them, about the way in which their neighbours live and work. It is a pity, where so much is well done, that facile conclusions on various aspects of industrial health should have been included. The collection of adequate data would, admittedly, have been an impossible task, but without them the subject were better left alone (incidentally detailed inquiries into the health of three of the industries discussed in this volume have been published in the last few years—printing, laundries and merchant seamen—but no reference is made to them). Thus we read that "it does not appear that the health of bakers in underground bakehouses is markedly worse than that of those employed above ground. Their complexions may be more 'pasty,' but they do not seem to suffer unduly from respiratory diseases."

No indication is given as to the means by which this conclusion was reached. Similarly it is difficult to see why it should be decided that the rather warm and artificially humidified atmosphere of parts of a tobacco factory " obviously has a beneficial result on the health of the workers." A third example may be seen in the statement that " at the present time over 90 per cent. of London milk is pasteurized, with results that may be seen in the reduction of the rate of infant mortality, particularly from such diseases as summer diarrhoea and enteritis. While other causes, as for example the increased use of dried milk during hot weather, increased dissemination of knowledge of infant welfare, the diminution of the plague of flies which has resulted from the tarring of roads and the substitution of motor for horse transport, have also contributed to this decline, yet such diseases are becoming less even in areas where these factors only operate to a lesser degree." This merely suggests an inadequate conception on the part of the investigator of the difficulties of interpreting time correlations. In a work that is likely to be regarded, rightly, as authoritative, the investigators should be specially on their guard against deductions which cannot be substantiated.

A. B. H.

2.—*Prices*. By George F. Warren, Ph.D., and Frank A. Pearson, Ph.D. London: Chapman and Hall, 1933. 9" × 6"; vi + 386 pp. 25s. net.

The authors, both Professors at Cornell University, set themselves a huge task. One can imagine a teacher posing to his class the question " Why is bread $4\frac{1}{2}d.$ a loaf? " being led therefrom to discuss what is meant by a price, and then to a historical sketch ranging from barter to the present-day depression. The authors in their introductory note consider that the individual should possess a knowledge of the laws of prices in order that he may conduct his business successfully, and in order to help guide public opinion in the direction of national progress. The present volume is issued with the object of helping the individual in these tasks.

Inevitably, the topics coming under discussion cover a wide range: Value, Money, Gold, Production, Stabilising the Price Level, Inflation and Deflation, Wealth, Taxes, Debts, Stocks. Index Numbers are used in order to illustrate changes in prices, production, etc., and the book is profusely illustrated with diagrams showing changes, in many cases changes over long periods of time (100 years). Relations are traced between series of figures which move together (*e.g.* indices of gold production and those of wholesale prices), lessons are learnt from previous crises in historical times. The book is a mine of information respecting past history of price movements generally, not only movements in the United States, but also movements in other countries.

The authors quote forecasts made by one or both in recent years, one of which may be reproduced here. In 1930 Professor Warren wrote: " What is needed is a currency more stable than gold. If this diagnosis is correct, it is time now to educate the public on money. When the question becomes political, it will be too late for real

study" (p. 123). Later on (p. 125), the authors, writing of the present depression, say that "it teaches the devastating effects of deflation, but teaches no other lesson that is good for society. The one lesson to be learned from it is that, if we are to have deflation, the miser is the wise man. The modern version of the miser who sells short is even wiser." To avoid this gloomy end and the equally dangerous effects of unbridled inflation, the compensated dollar (miscalled the rubber dollar) is advocated. By this means the price level is to be rendered stable, the amount of gold for which a dollar is redeemable varying with the price index number. But first the price level must be restored to the level of a few years back. Not all prices would be raised during this process, "in general, the prices that have not yet declined would be relieved from declining, and those that have declined would be restored."

Somehow the outlook does not appear as promising as the authors suggest, if the course of events they recommend is entered upon. An important factor is the political one, which they refer to as having influence in emergencies; but surely it is ever-present. Another factor is psychological. It may be easy for an executive to decide that during a period of poor trade the operatives should continue in employment for the same wages without being expected to work so hard, so long as the finances of the undertaking warrant, but when the good times come and the executive expects its hands to accept these same wages for 25 per cent. more effort, there will probably be a demand from them for a greater share in the profits. The original gesture on the part of the executive will be forgotten; memories are short. Here enter strikes or political action. The authors say, "Many charges, such as freight rates, doctors' fees, telephone rates, and the like, are already adjusted to the price level that would be established. They would not rise, but would be relieved from falling" (p. 371). Why should not doctors try to get more for their services, if they feel that the community can afford to pay? Can one be confident in England that, if a rise in prices occurs with improved trade and profitability of undertakings, there will not be a demand by labour for higher wages, even though it is well known that wage levels have not fallen to the same degree as the cost of living.

The authorities are not in entire agreement on the reasons why the world is in its present economic condition; they do not all agree on the method of extricating the world from the morass in which it is floundering, though there is reasonable agreement that the method of universal bankruptcies should be avoided. The United States of America is in the process of an attempted cure, an economic experiment on the grand scale. The world will welcome and applaud a successful outcome.

E. C. R.

3.—*Monetary Policy and the Depression*; a First Report on International Monetary Problems by a Group of the Royal Institute of International Affairs. Oxford University Press, and Humphrey Milford, London, 1933. 9 $\frac{3}{4}$ " \times 6 $\frac{1}{4}$ "; vii + 128 pp. 7s. 6d.

This report was prepared by a Group of which the chairman is Sir Charles Addis, and its object is "to survey and analyse the

bearing of monetary policy on the present depression, and to describe and discuss various suggestions put forward for the alleviation of the present state of affairs and the better ordering of the world's monetary system. . . . Specific recommendations . . . must come at a later stage." A narrow view of the subject has not been taken. "Looked at in all its implications, the monetary question covers not merely the working of financial institutions, but also the uses to which loans are put by Governments, by the business community, and by the general public. Again, the behaviour of non-monetary factors must also affect the working of the monetary machine." The Report opens with a brief but accurate sketch of the condition of the leading countries before 1930, from which there disengage themselves, as among the salient features, indiscreet borrowing and the existence of a mass of short term money moving from market to market under the forces of fear or interest. Next, the importance of new investment is demonstrated, and it is shown how any dislocation between "saving" and "investment" leads to a loss of consuming power and to depression, which shows itself in a fall in prices, or in a decrease in the quantity of goods sold, or in both. The burden of past debts then becomes excessive; the fall in the price of primary goods exceeds that of the price of manufactured goods, and wholesale and retail prices tend to move differently. The whole of the old national and international price-structures is upset.

The problem is to bring costs and prices once more into line, either to raise prices to a sufficient level or to write down existing obligations. Three theoretical points of view are discussed:—the monetary, that the fall in prices is due to the non-use of gold and to tariffs, and that a large increase of credit will force new capital developments; the structural, that confidence will be restored "by a drastic and salutary cutting down of costs and bankruptcy of uneconomic units in all parts of the system," or, to put it otherwise, by allowing the forces of competition to have full sway irrespective of trade unions, trusts, and Governments; and thirdly, Professor Ohlin's view that to lower costs (wages and debts) in consumption industries would lead to disaster and that prices should be raised by reducing building costs and issuing loans for building, railway equipment, etc., so as to increase incomes and purchasing power. All three agree in advocating capital development, cheap money, and increased private spending, but the structural school object to public works which the other schools favour. The arguments for and against each of these schools of thought are clearly and succinctly set out, and the general conclusion is that "no recovery, it is generally agreed, can be really solidly grounded unless it is accompanied by a restoration of activity in those trades (as, for example, building and machinery) for whose products new investment creates a demand." Borrowers will only borrow if they see a prospect of profit and if they are sure that the charges for loans will not fall. In this connexion the Report discusses "cheap money" (including not only a low Bank rate but lower rates on advances), the future of interest rates, better machinery for internal development, and Government investment in public works. The necessity of inter-

national co-operation is then stressed. "The effect of the independent evolution of the various national economies is to produce variations in costs. On the other hand, the external forces to which every national economy is subjected are always trying through the medium of the exchanges and the working of the gold standard to equate costs." The reduction of debts and the lowering of tariffs come under discussion, and the cases for and against an early return to gold are summarized. Finally, in appendices there are valuable notes on interest rates and on state-controlled capital expenditure, a useful "chronology of the depression," a tabular statement of exchange restrictions in various countries, and a short bibliography.

The world is swept by a torrent of books on all phases of the "depression" and on all forms of cure for industrial and monetary woes. This Report, so clearly and concisely written and with such a complete lack of bias, will form an admirable guide to most of what is valuable in the outpourings of the controversialists, and should aid all those interested, that is to say, everybody, in making up their minds. The Group propose to continue their discussions and to examine the relative merits of the possible solutions which have been outlined in their First Report, and we shall look forward with interest to the result.

H. W. M.

4.—*Theory of the Credit Standard*. By Hans Glückstadt. London: P. S. King, 1933. $8\frac{1}{2}'' \times 5\frac{1}{2}''$; xv + 345 pp. 1s.

The Mechanism of the Credit Standard. Practical Proposals for a New Monetary Standard. By Hans Glückstadt, B.Sc.(Econ.). London: P. S. King, 1933. $8\frac{1}{2}'' \times 5\frac{1}{2}''$; xiii + 111 pp. 7s. 6d.

The dramatic upheaval of the world's monetary systems of the last few years has produced an extensive literature on the subject of the causes and cures of our troubles. Mr. Glückstadt is one of the writers who aim at devising a permanent cure for the instabilities of the monetary and economic mechanism. Unlike several other economists who have the same objective in view, he does not wish to see stable prices, but a stable value of money. That is to say, if either the quality of goods should change or costs of production fall owing, for example, to rationalization, prices must be correspondingly adjusted or the real purchasing power of money is in fact changed. Mr. Glückstadt, for instance, regards, as the fundamental cause of the American smash the fact that prices were stable when costs of production were falling. There is of course nothing new in his theory that prices must be adjusted to changes emanating from the side of supply if stability is to be obtained, but at the present time when so many writers, obsessed by the tragedy of falling prices, are clamouring for stable prices as the main desideratum, Mr. Glückstadt's insistence on what he calls objective commodity value and the stability of commodity values is welcome and valuable.

His scheme for ensuring stability is based on various theses. Firstly, the gold standard, he maintains, is completely superseded; the value of gold, being itself unstable, cannot provide the basis of a stable system. In the place of gold he wishes to see as the international money of account a note issued by a new international

bank which would form the basis of all national currencies. Secondly, he argues that it is not merely the note issue of a country which needs to be controlled, but its total supply of money, including all forms of cheque money. On the strength of this view he labels his theory the "totality theory." Thirdly, he develops the interesting line of argument that the demand for money in the past corresponds closely with the world's production of pig-iron, and that the past trend of this demand gives an adequate indication of the future demand for money. He supports his view with graphs and tables which are certainly suggestive. On the basis of this assumption he then develops in detail a scheme for regulating the national currency through establishing a relation between cheque money and the note and between the note and international currency. The new international currency would be allocated to the different countries on the basis of their demand for money, and the total cheque money of each country would be controlled by the introduction of a fixed note reserve.

This gives the barest outline of a scheme which is, in fact, worked out with much elaborate abstract reasoning in the greatest detail. Mr. Glückstadt, for instance, even goes so far as to demand that the "cheque banks" should be given the monopoly of receiving deposits on-demand and at short notice up to one month, and that the savings banks should have the monopoly of long-term deposits, so that the control of cheque money should not be complicated by being linked up with matters which rightly concern the capital market. The whole scheme, in fact, is singularly clear-cut and rigid, and presupposes that the nations of the world will be prepared simultaneously to introduce drastic changes in their financial and banking organization. It smacks, that is to say, more of the academic laboratory than of the world of affairs.

Although one may not regard Mr. Glückstadt's two books as providing a practical solution of present-day economic problems, there is much in them which is interesting and suggestive, especially in his earlier and longer work, *The Theory of the Credit Standard*, which has a wealth of valuable statistical material in the appendices. The later book gives only a brief "A.B.C." of his theories and then elaborates detailed questions connected with the organization of the proposed international bank and currency. This book, *The Mechanism of the Credit Standard*, has been excellently translated by S. J. H. Moorhouse. Unfortunately the translation of the earlier work emanates from Danish sources and its foreign origin is very apparent; there is an awkwardness of phrasing which at times makes the ideas expressed difficult to grasp. W. A. E.

5.—*L'Étalon-Or, en Théorie et en Pratique*. By Xénophon Zolotas, Professeur d'Économie Politique à l'Université d'Athènes. Paris: Librairie du Recueil Sirey, 1933. 9" × 5½"; 266 pp. 25 fr.

Professor Zolotas's book has little to offer the expert, but the student will find it a useful work, both comprehensive and clear. The first part gives a theoretical discussion of the working of the gold standard in normal times and for the most part deals with the

necessary aspects of the question on well-recognized lines, though perhaps the author somewhat fails sufficiently to stress the fact that it is the free exportability of gold, rather than the nominal right of conversion, which is the essence of the gold standard.

The second part of the book is concerned with the developments of the last few years and the failure to maintain the gold standard. The subjects dealt with are so controversial that it is impossible to discuss them without rousing criticism in one quarter or another. Some readers will probably consider the author too pessimistic about the possibilities of the gold exchange standard and too optimistic, in the first part of the book, about the future supplies of gold. His criticism of the Report of the Gold Delegation on this point is not particularly convincing, and in fact evades the issue, since part of his argument is that with continually falling prices due to a shortage of gold, the demand for gold for monetary purposes will fall. No one doubts that the world economy will perforce adapt itself somehow to a falling output of gold; the question is whether it can do so without a reduction in the world output of commodities, and this point he never considers. But since in a book of this nature it is impossible to agree with everyone, the important thing is to suggest the main lines of discussion and to review them intelligently, and this Professor Zolotas has certainly done for the most part. He includes a brief survey of the working of the gold exchange standard, the concentration of gold in the United States, the effects of the parities chosen for stabilization in Great Britain and France, the peculiarities of the movements of capital, the effects of tariff restrictions, and the lack of co-operation and mistakes of the Central Banks. In this last connection he deals with the raising of the bank rate by the Federal Reserve Board during the speculative boom and the high bank rate maintained by the Bank of France and their effects on gold distribution.

Various points of detail are open to criticism. Thus, in dealing with effects on prices of the re-introduction of the gold standard in this country, it is an obvious weakness to give a table of prices which starts only with 1925, instead of showing how the movement of prices varied before and after the revalorization of the pound. The book has also been carelessly proof-read and there are various glaring misprints. Thus on p. 162 the author talks of the loss of gold from the United States in 1917 instead of in 1919. The other mistakes are too obvious to be of importance, but it is startling to find North Africa tabulated as the chief gold-producing country of the world!

W. A. E.

6.—*Essais sur quelques Problèmes Économiques et Monétaires.* By Charles Rist, Professeur à la Faculté de Droit de Paris, Membre de l'Institut. Paris: Recueil Sirey, 1933. 9 $\frac{3}{4}$ " x 6 $\frac{1}{2}$ "; xvi + 501 pp. 70 fr.

In this volume Professor Rist has collected a number of essays dealing with a wide range of subjects and written over a considerable period of time. One section of the book is headed "Études de Théorie," and includes two long essays on "Théorie de l'Épargne"

and "Économie Optimiste et Économie Scientifique," the latter dealing with questions of the distribution of wealth. This, on the whole, is the least interesting part of the book, since Professor Rist has far too realistic a mind to be at his best on matters of theory. In the other sections, two of the essays, those dealing with *Le Mouvement de Grève en France* and *Les Finances des Syndicats Ouvriers Français* are of too specialized an interest to appeal to more than a small number of readers in this country. The bulk of the volume, however, deals with financial subjects and will attract a wider audience. Two of the essays are historical surveys of financial developments, the subjects being *Circulation Monétaire Française de 1878 à 1910*, and *La Hausse du Taux de l'Intérêt*. Professor Rist's arguments and statements in these are copiously illustrated by figures and graphs and those whose interests lie along these lines will find a wealth of statistical material clearly and succinctly set out.

The remaining essays, some ten in all, are on more topical matters, or at least problems which were topical at the time of writing. Such a subject as the Economic Situation in Austria in 1922 or a plea for the stabilization of the franc, written in 1925, have by now primarily a historic interest, so vastly have conditions changed since they were written. Essays reprinted after a lapse of years on topics such as these, which have been extensively explored, can hardly be expected to shed new light on the problems concerned, however clear and workmanlike the handling of them may be. Yet the lessons of those days have by no means been universally accepted in practice, and their repetition does not come amiss. It is refreshing and valuable, for example, to find Professor Rist stating that when a currency is depreciated, a rapid acceleration of exports and a heavy fall in imports may be signs of what he calls a "pathological" state, rather than signs of prosperity. The two brief essays on reparations, written in 1919 and 1922 respectively, also add nothing fresh to one's knowledge of the subject, but they serve at least as a tribute to Professor Rist's detachment and integrity of thought, since it was by no means every economist in France who was prepared at that time to stress the impossibility of combining vast reparation payments with the restriction of imports from Germany.

Besides the essays already referred to there is a whole group dealing with various aspects of the recent crisis and present depression. They include a reprint of the lecture delivered in 1931 at the Royal Institute of International Affairs on *La "Mauvaise" Répartition de l'Or dans le Monde*. This has already been published in English in the volume on the International Gold Problem and is doubtless familiar to many readers of this *Journal*. They will remember that Professor Rist regards the maldistribution of gold purely as a sign of maladjustment of capital and not in any sense as a cause of the fall in prices and the stagnation of trade. The fall in prices he looks upon as inevitable, since prices in the United States during and after the War were artificially high and it was this artificial level which determined world prices as other nations went back to gold. A return to the 1928 price level he therefore concludes

is chimerical. (Retrouvera-t-on le niveau des prix de 1928 ?) Professor Rist is poles asunder from the many economists who to-day are forming ingenious plans for managed currencies and artificially produced stability of prices. He still holds allegiance to the old orthodoxy. There is nothing wrong, he considers, with the gold standard as such, only with the way it has been worked. (Le Mécanisme de l'Étalon d'Or a-t-il été faussé.) The trouble has been due to such errors of judgment, amongst others, as the choice of wrong rates for stabilization, unwillingness to put up rates of discount sufficiently to prevent gold withdrawals, the tying up of short-term deposits in long-term investments by the commercial banks, and of course the American speculative boom. The crisis, he considers, is not essentially different from those of the past, but has taken place in the abnormal circumstances of post-war conditions, but, be it noted, he does not suggest that the payment of war-debts and reparations are included in these abnormal circumstances.

In his article on the Spanish peseta (written in 1929) Professor Rist is on somewhat less familiar ground, and for that reason it is possible some readers may find this article the most interesting in the book. The problems that Spain has had to face differ in many respects from those found elsewhere. The internal purchasing power of the peseta has been relatively low. There was no budget deficit financed by the inflation of the currency. On the other hand, the situation was complicated by the presence of a silver reserve and by the large volume of loans for the extraordinary budget on account of the railways.

It is perhaps unnecessary to add that whether the material of these essays is familiar or not it is always set out with clearness and distinction.

W. A. E.

7.—*The Theory of Unemployment.* By A. C. Pigou, M.A. London: Macmillan, 1933. 8½" x 5¼". xxv + 319 pp. 15s. net.

Professor Pigou rightly indicates in his preface that this book is written for economists and not for the general public. It is "strictly academic in tone and content" and its reading demands concentrated attention. The analysis throughout is theoretical, the aim being to clarify thought, but numerous conclusions emerge which are of practical value in framing policy. The book is complementary to *Industrial Fluctuations* by the same author.

The problem is approached from the "real" end instead of from the money end, the author holding the view that the result of concentration by economists in recent years upon the money end has been "to over-stress somewhat the rôle that money plays in more normal times and to put in the background very important factors of a non-monetary character." The monetary factor is introduced, but only at a relatively late stage.

The whole problem is treated as a short-period one, in the sense that slow-working reactions from changes in fixed capital equipment are left out of account. Much less attention is given to the supply side than to that of demand, largely, no doubt, because the analysis

is mainly concerned with the short period. Mathematical symbols and methods of analysis, including some differential calculus, are freely used, but the greater part of the book is intelligible to the non-mathematical economist. Some of the conclusions can be reached by more direct methods, but for others mathematical technique offers the most convenient route. Much of the "arithmetical of unemployment" (Part I, Chapter V) could have been expressed equally well verbally as by symbols. Some of the theoretical analysis disappoints by leading to indeterminate solutions, or because, though simple solutions in symbols may be obtained, lack of adequate statistics prevents concrete conclusions from being reached except within wide limits. At certain points factual estimates or even guesses, about the reliability of which doubts may be raised, are made with a view to reaching conclusions, but, as Professor Pigou points out (p. 88), "from the point of view of economic science it is the method of analysis, rather than these results, to which attention is invited."

It is not possible here to give details of the elaborate analysis. In brief, Part I consists of definitions, a discussion of the cost of unemployment and other introductory matter. The next three Parts deal with the elasticity of the real demand for labour, and with factors affecting the level and variations in the level of the real demand function for labour. Part V gives an analysis of the causation of unemployment and of changes in unemployment. Much of the argument is based upon a distinction between "wage-goods" and "non-wage-goods." This distinction presents no theoretical but considerable practical difficulties which would increase as inequalities of income between wage-earners and other classes diminished; the line of demarcation would become still more blurred.

Reference may be made to some of the chief conclusions. It is shown (pp. 15 and 16) that short periods of unemployment spread over many workpeople involve less subjective cost than long periods concentrated upon a relatively small number of workpeople. This lends support to the policy of systematic spreading of work during depression by rotation of employment among all except those bordering on the unemployable. The discussion of the elasticity of demand for labour as a whole leads to the fairly confident claim (p. 106) that, with certain qualifications, "in times of deep depression, after an interval not less than the period of production of the generality of wage-goods and export goods, an all-round cut of 10 per cent. in money rates of wages would lead, *other things being equal*, to a more than 10 per cent. expansion in the aggregate volume of labour demanded, and so, apart from unfilled vacancies, in the volume of employment." This, of course, has little bearing, taking a long view, upon the soundness or unsoundness of the policy adopted by organized labour of resisting wage reductions.

Certain limitations and qualifications may modify the conclusion (p. 155) that in so far as purchasing power, including gratuitous payments to poor people and contributions to social services, is transferred from non-wage-earners as a body to wage-earners as a body, these transfers, other things being equal, render the aggregate

quantity of labour demanded at a given real rate of wage smaller than it would have been had no such transfers taken place.

On the question of import restrictions many economists will agree that "for a country situated as England is, there is only a very small group of commodity imports (as distinguished from security imports, the estoppel or restriction of which can be expected with any confidence to exercise even a small favourable effect on the real demand for labour at home" (p. 177). As the author states, this does not allow for possible effects of import restrictions upon the price level, and so indirectly, in so far as money wages are rigid, on the rate of real wage for which workpeople stipulate.

In Part IV, a standard monetary system having been defined, it is shown that departures from that system increase disturbances of the real demand function for labour. A policy of cheap money and public works, especially if applied by a group of countries acting in unison, would help to maintain the standard monetary system in times of deep depression and would lessen the decline in the real demand for labour. As, under actual monetary systems, a rise in prices leads to the expectation of further rises, generating a cumulative movement, a small expenditure on public works in bad times *might* lead to a progressive and far-reaching improvement in the employment situation. On banking policy it is argued (pp. 216 and 231) that "in the face of an upward movement in the demand for labour initiated on the real side, banking systems, as currently operated, always allow the actual rate of bank interest to rise less than the *proper* rate," and the converse is also true; thus the aggregate real demand function for labour fluctuates more widely than it otherwise would.

Expectations of price-falls and also the holding up of money rates of wages in the face of a reduced price level are shown to exercise more important effects in depressing the real demand function for labour than the fact that prices *have* fallen. The fact that prices have fallen has, however, considerable effects through various other relatively inflexible costs; for example, interest and taxation charges. There is a useful reminder (p. 218) that, taking a general view of the great depression, the maldistribution of gold cannot possibly be a prime mover.

Early in Part V the conclusion is reached that "the long-run effect of expansionist State policies . . . does not touch unemployment," but, as already indicated, this does not imply that such policies may not be effectively applied *temporarily* as "remedies" for unemployment in times of exceptional depression. The greater unemployment in Britain in post-war than in pre-war years suggests strongly "that the goal of long-run tendencies in recent times has been a wage level substantially above that proper to nil unemployment, and that a substantial part of post-war unemployment is attributable to that fact;" the maintenance of the wage level has been facilitated by the system of unemployment insurance. However, the changed conditions of world trade, the vulnerability of some British export industries, the length of the period necessary to readjust British industrial structure to the changed conditions,

and the general consequences of deflationary trends must also bear a considerable share of the responsibility for high post-war unemployment. The general conclusion is also reached that as a remedy for the heavy unemployment of the post-war period, a mere correction of wage inequalities between sheltered and unsheltered industries, in such wise as to keep average wages constant, would probably have proved not merely unavailing, but actually harmful.

The policy of transferring workers from the exceptionally depressed areas is discussed, as is also the greater difficulty of meeting relative variations in the demand for labour in a stationary or declining than in an expanding population of working age. The significance of statistical correlations between changes in employment and in real wage rates is examined with special reference to the investigations of M. Jacques Rueff, and it is argued that during the period 1920 to 1930 "we cannot affirm with any confidence that the main part of the recorded changes in employment would not have taken place had the recorded shifts of real wage-rates been estopped."

For comprehensive theoretical analysis this book is a valuable contribution to the academic study of the subject, and it is useful that such a book should be published from time to time in these days of the "vulgarisation" of economics. J. H. R.

8.—*Purchasing Power and Trade Depression: A Critique of Under-consumption Theories.* By E. F. M. Durbin, B.A. London: Jonathan Cape, 1933. 7½" × 5"; 198 pp. 6s. net.

This is an extremely interesting though confusing book. Ostensibly aimed at the theories of under-consumption associated with the names of Major C. H. Douglas, Mr. J. A. Hobson, and Lieut.-Col. Powell, it is really an onslaught on what has always been one of the weakest links in the chain of monetary reasoning associated, in this country, more especially with the names of Mr. R. G. Hawtrey and Mr. J. M. Keynes. Mr. Durbin, however, appears quite unaware of this, for towards the end of his book he outlines an explanation of the "trade cycle," which attempts to reconcile Mr. Keynes's analysis not only with that of Professor Hayek, but with his own ideas. Since this involves trying to make the best of what are probably three irreconcilable worlds—one *real* and two *unreal*—it does not add to our enlightenment. It is time that it began to be realized that it is possible to describe the same *real* events in the terms of more than one set of *abstractions*. This means that it is possible to have more than one abstract theory of economics; each of which may be equally true so long as it is confined to the particular framework of abstractions to which it belongs. In the Universe of abstraction there is more than one possible world. Economists generally are apt to assume too readily that because all their theories use the same words to denote their basic abstractions, e.g. "prices," "investments," "savings," etc.—words which have a more or less precise meaning in real life—that these same words also have a *common* meaning in their theories. Nothing is probably farther from the truth. Few of their theories, even when they use the same abstrac-

tions, seem to define them in the same way. The recent controversy between the respective schools associated with the names of Professor Hayek and Mr. Keynes is an interesting illustration of this.

The importance of Mr. Durbin's contribution—and it appears to be a genuine one—is that when he comes down to an actual discussion of the problem of savings and investment—the main theme of his book—he deliberately discards both the theoretical avenues of approach mentioned above. In their place he adopts more nearly the attitude of a realist who enquires: For what purpose does a business man invest savings? Most economists have, like Mr. Hawtrey, been content to ignore this problem, regarding it as adequately comprehended in their broad theoretical generalizations regarding the monetary aspect of trade-cycle phenomena. Others who have tried to take the matter a stage further in the world of theory have tended to become confused by their own definitions. Mr. Keynes, for example, seems to come near this, although actually he too avoids the real issue by the circumlocution of treating the difference between prices and costs as synonymous with the difference between savings and investment: his "savings," as Mr. Hawtrey has pointed out, being the same thing as his "investment," if we exclude the traders' losses which, according to his definition, are the same thing as the excess of savings which accumulate in times of depression. Mr. Durbin's answer to his own question is that, excluding savings used to provide additions to equipment and commodities of the existing type to meet the natural growth in population, the main purpose for which a business man invests money in a progressive "capitalistic" community, is to lay down plant which will enable him to produce more cheaply, *i.e.* to reduce costs. He says "I hold that the real mistake they (*i.e.* the *under-consumption theorists*) have made is that of neglecting the effects of investment upon output, efficiency, and costs rather than the effect on the total of monetary payments; and I do not think that Mr. Keynes himself has fully apprehended the significance of the problems with which one aspect of the theories of under-consumption is concerned."

Employing this theory, Mr. Durbin finds no difficulty in demolishing certain of the cruder forms of the under-consumption theory, though, in the opinion of the reviewer, at any rate, something still remains to be said on the central issue. His treatment of the trade cycle, as already indicated, is less satisfactory. If in the next book to which we are encouraged to look forward Mr. Durbin will approach the trade cycle along the same realistic path as that which he has followed to resolve the savings-investment relation; that is to say, analyse it as a "natural" phenomenon which is part of the problem of growth (*i.e.* of a growth whose secular rate, like that of all forms of living matter, tends to vary with the age and structure of the growing organism), he may find it possible to replace his present eclectic theory by one which will be of greater practical value.

This is an independent and stimulating book which is especially to be commended to those who are tired of being compelled to turn over the same old ground, and are ready to adventure into new and—because of the lack of an accepted instrument of exploration—

dangerous territory. It is to be regretted that this task of exploration should have been rendered even more difficult than it need be by a number of somewhat confusing misprints. R. G.

9.—*Early European Banking in India*, with Some Reflections on Present Conditions. By H. Sinha. London: Macmillan, 1927. 9 $\frac{3}{4}$ " \times 5 $\frac{1}{2}$ "; iv + 274 pp. 12s. 6d.

Although this book was published some years ago the present concern about Indian finance and about proposals for the establishment of a Central Bank may justify a brief notice of it; much of the early history, moreover, is in itself of great interest. The period covered is from 1770 to 1809. About 1770 the Bank of Hindostan was started in connexion with Messrs. Alexander & Co., one of the leading Agency Houses of the time, and was followed by the Bengal Bank in 1784; the chief proprietors of the latter were Company servants: it issued notes, and tried to introduce the cheque system. More important was the General Bank of India, established in 1786, one-third of its capital "including its extension by the issue of notes" (a clause deleted later) was to be always held in specie, overdrafts were not allowed, and the liability of the shareholders was limited to the amount of their shares—thus preceding the adoption of limited liability for bank shares in England by seventy-four years. This bank made a loan of 20 million rupees to the Government and became virtually the Government bank until in 1788–89 the connexion was severed on the curious plea that the high discount on gold was due to the circulation of bank notes. This loss of prestige and the drain of specie from Calcutta for the prosecution of the Mysore War prevented the bank from reconstituting itself at the end of the five years for which it had been formed. The other two banks had also to appeal for Government assistance in the crisis of 1791 and the Bengal Bank, in fact, did not survive. The Bank of Hindostan was unable to cope with the demands of business and the currency was in a chaotic state, so the Bank of Calcutta was set up in 1806 and was subsequently given a charter as the Bank of Bengal in 1809. In effect this bank was the realisation of Sir James Steuart's scheme of 1772 for the establishment of a bank of issue, independent of the Government but with a capital subscribed by Government officials. Three of the nine directors of the Bank of Bengal were appointed by the Government, but civil servants were forbidden to hold shares and the Government debt to the Bank at any time was limited to 5 million rupees. The modern era in Indian banking may now be regarded as begun: the deficiency of currency was remedied and the credit of the Government and of Government securities was improved. All this old history is admirably illustrated with extracts from regulations, copies of old notes, post bills, etc., and Dr. Sinha is to be congratulated on and thanked for the great labour he has shown in unearthing contemporary records.

The second part of the book emphasises the fact that the main contribution of European banking to India was the creation of a sound paper currency. In the early days the banks had to support an impecunious Government; to-day the Government lends to its

bank. Even to-day, he thinks, banks work with insufficient reserves and the Money Market is unorganised, partly by the participation of the Imperial Bank in ordinary banking business. He approves of a State Central Bank, but points out that it does not solve all problems. The difficulties of industrial investment are stressed and the development of debentures (little used in India) is suggested. The institution of more and better stock exchanges, the creation of investment trusts, the establishment of industrial banks and of a land bank are other proposals which are considered and generally approved; frequent reference is made here to the practices of the old banks. Finally, he prefers a gold standard and a gold currency to a gold bullion standard. Dr. Sinha is a practical banker as well as a skilled statistician and economist and his views, which are set out with brevity, clarity, and moderation, deserve consideration from students of Indian Finance. He is, it may be added, a Fellow of this Society and Joint Secretary of the Indian Statistical Society.

H. W. M.

10.—*The Logic of Industrial Organization*. By P. Sargant Florence. London: Kegan Paul, Trench, Trübner, 1933. 8 $\frac{3}{4}$ " \times 5 $\frac{1}{2}$ "; xi + 280 pp. 10s. 6d. net.

Management of To-morrow. By L. Urwick. London: Nisbet, 1933. 8 $\frac{3}{4}$ " \times 5 $\frac{1}{2}$ "; xvii + 205 pp. 8s. 6d. net.

The "logic" of industrial organization, the "philosophy" of management, and the "pure theory" of organization are tiresome phrases, but the subject to which they relate is important and is beginning to assume a definite form and content. The two books under review light up, from different angles and with a different aim, the same body of ideas. The one is, not a treatise, but a bright and clearly-cut outline of one. The other is more a tract than a treatise, a persuasive and well-supported plea for the extension of the scientific spirit in business administration. The intention of the one may be assessed as primarily academic, the other as practical; but this is not to say that a business administrator with an economic grounding might not find Professor Florence's book open up, in some ways, more perspectives than Mr. Urwick's.

Mr. Florence organizes his material round the notion that the "logic" of the industrial system—which exists to supply the wants of society as completely as possible at the minimum aggregate cost of all kinds—lies in large-scale operation. With this touchstone and a scientific eye he examines the actual situation and endeavours to evaluate the elements that make for irrational, illogical and inefficient operation. He starts with a skilful study of the characteristics of the market under free consumption as an external limit to the efficiency of large-scale operation. The features and possibilities of market research and forecasting, of organized marketing methods, and rationalization, are analysed and fitted into their place. The analysis proceeds to the internal problems of large-scale organization. The structural problems which arise with increased scale are dealt with under the head of Investment, Employment and Management Relations. In this section, the interaction of investment and

employment, introducing the topics of technological unemployment, fatigue, short hours and multiple shifts, is perhaps less successfully treated than management, which is dealt with in an admirable survey of systems of organization and of the problem of ultimate control. In large-scale organization there is an underlying problem of producing in the workers and the management "a parallelism of wills in terms of concurrent interests": and, throughout the system, a danger that the technical conditions which are set up may "cut across social and psychological inducements and conduces to efficient work and efficient movement and adjustment." These problems are dealt with as the Stimulus to Labour in a section which, while not exhausting the subject, contains some highly suggestive matter; as the Stimulus to Investment in a treatment which is perhaps rather jejune; and as the Stimulus to Enterprise and Administration. The last-named analyses the functions of the higher controlling authority in business organizations and the types of persons who actually exercise it. This analysis is the basis of a discussion of the short-period and the long-period supply price of business administration and, in connection with the latter, the bearing of existing education on the supply.

An outline so extensive must almost necessarily be sketchy in parts; but the author has made good use of his equipment, economic, statistical and psychological, and, if his distinctions and analyses are not all likely to stand, he has drawn, nevertheless, a balanced and well-documented outline of the subject, fitting into due relation a great range of problems and, as previously said, opening up wide perspectives.

Mr. Urwick's book skilfully combines into a connected form the substance of papers which, over a period of years, he has read to various associations. These all centre on or illustrate the scientific approach to business problems and are impressive by reason of the authoritative reference which the author, who is the director of the International Management Institute at Geneva, is able to make, not only to the literature of the subject, but to what has been achieved in practice in many countries in business organization and in co-operation and research directed towards its improvement. In the way of original contribution, the chief item is a chapter in which the author advocates the introduction into business of staff organization on the army model as a necessary advance on the various forms of staff and line conception. There are papers on Marketing and Distribution, and on Training for Management, where the education and the training of the administrator, properly contradistinguished, are dealt with. But the keynote of the book is the reiterated emphasis which it lays on the need for research into management (as to subjects for which many noteworthy suggestions are made), and the need for the co-ordination and the publication of the statistical material which already exists in the possession of agencies both public and private, "a larger part," Mr. Urwick says, "of the necessary basis than is commonly supposed."

The faith and fire of the management movement, if it may be so called, burns with a more gem-like flame in Mr. Urwick than in Professor Florence; but both give solid reasons for believing that

a technique of management has developed and is developing; and both emphasize its social importance. W. P.

11.—*Australia in the World Depression*. By E. Ronald Walker, M.A., Ph.D., Lecturer in Economics in the University of Sydney. London: P. S. King, 1933. 8 $\frac{3}{4}$ " \times 5 $\frac{1}{4}$ "; xi + 219 pp. 10s. 6d.

This book is particularly interesting because Australia was one of the first countries to suffer from the world depression and one of the first to show signs of recovery. Defective statistics make it difficult to measure the extent of the calamity, but probably the estimate of the Wallace-Bruce Committee that the national income fell from £105 to £71 per head between 1926-27 and 1930-31 and the "real" national income (in terms of goods) from £106 to £80 may be as good an indication as any. History shows that internal depressions in Australia synchronise more or less with general depressions. The contacts of the Commonwealth with the outside world consist in exports, chiefly of wool and wheat which formed 61.3 per cent. of the total exports in the period 1924-25 to 1928-29 and 77 per cent. of the wool clip and 67 per cent. of the wheat crop respectively; other exports are of less individual importance and in some cases, such as sugar, butter, and dried fruits, are subsidized. Perhaps a quarter of the total national production was exported to a limited number of markets, and the specialized character of the export trade infused a certain precariousness into the Australian economy; the idea of a national self-sufficiency supported by a high tariff was far from realized. Meantime the dependence of Australia on the mother country for supplies of capital increased, the public debt raised overseas for other than War purposes having increased by £213 millions or by over 80 per cent. in the period 1919-20 to 1927-28. Any reduction in overseas borrowing (which had been incurred partly to stimulate migration) was bound to affect adversely the balance of payments and the exchanges, to reduce investment within the country, and, consequently, to react seriously on the economic position of the Commonwealth.

During the boom a thriving export trade led to an increase in the balances of the Australian banks in London, and these were regarded as a second line of reserve against liabilities. The traditional banking policy was not to maintain a conventional ratio of cash to deposits but to ration loans instead of manipulating the rate of interest and to keep a steady rate of exchange. The inflated incomes of export producers automatically expanded deposits and London balances; if the resultant demand for imports rose rapidly enough against a tariff intended to keep imports down there would be little credit expansion, but "if they are sluggish, the banks will be in a position to indulge in a protracted boom." One result of a high tariff is an inflationary credit policy; "thus it can be concluded that the increase in bank advances (excluding the Commonwealth Bank) from £168 millions in 1921-22 to £268 millions in 1928-29 was due not merely to heavy borrowings and high export values, but also to the formidable height of the tariff." Commonwealth and State loan expenditure on public works exceeded £284 millions

in the seven years 1923-24 to 1928-29. During the post-war boom unemployment was higher than it had been before the War and statistics show that it was not associated with high wages but with short-term instability of business resulting in the accumulation of a "reserve" of labour, partly due to the tariff which stimulated the multiplicity of small inexperienced firms in manufacturing industries. Another feature of the period was a rising public expenditure, especially in wages and salaries, out of a revenue largely raised from duties on imports which the tariff strove to restrict.

Australia was thus in not too sound a position when it was struck by the economic blizzard which, between 1929 and 1932, brought down the world price of wool by 50 per cent. and that of wheat by 60 per cent. with large reductions also in meat, hides, and non-ferrous metals. Primary producers were doubly hit, by the fall in what they had to sell and by high wages and high cost of manufactured goods. The world output of merino wool rose by 33 per cent. between 1924 and 1929, that of Australia by 26 per cent.; the world output of wheat rose by over a third between 1920 and 1928 and then fell by about 5 per cent. to 1930 while the Australian production rose with many fluctuations by 9 per cent. in 1920-28 and by 34 per cent. in 1928-30. Australia thus contributed materially towards the crisis in wool and wheat, but though the "grow more wheat" campaign was mistaken it was American surplus stocks which dominated the wheat market. Another depressing factor on Australian credit was the uneasiness London began to feel as to the growth of antipodean borrowing, but, apart from some cases of extravagance, the loans were mainly applied in the construction of railways, in water supply, and in other schemes of development of national resources; still, as Dr. Walker shows, the interest on the loans was an increasing burden on national output.

The fifth chapter relates in considerable detail how collapse was averted in 1931 by a legal reduction of wages, by freeing the exchanges, by making economies to balance budgets, and by reducing, through conversion, the burden of internal loans. There was a little inflation by Government borrowing, the banks being able to expand credit through the increase of the floating debt, and in this way wages had not to be reduced as far as would otherwise have been necessary. The sixth, and in some respects the most important chapter is entitled "theoretical problems associated with policy," and, in the course of an exploration of the doctrines of Keynes and Hayek (to the latter of which, with some important modifications, the author adheres), gives an acute analysis of the proposition that wage-cuts diminish purchasing power and retard recovery. We have seen no other such detailed examination of the problem, revealing under what conditions the doctrine is true and under which it fails; it is a real addition to economic theory. Briefly, "there is sufficient truth in the purchasing-power argument to prevent a general wage reduction from causing a vast reduction of employment during a slump," but much depends on the attitude of entrepreneurs, whether with reduced costs they will at once increase

output or whether they will wait to see if reduced prices call forth increased demand; if the latter course is adopted there will be a temporary hoarding of resources and a reduction of employment. On the whole, Dr. Walker concludes that the recovery in Australia in 1932 was mainly due to the mild inflation incident on Government borrowing to cover deficits and to the increase of confidence generated by the displacement of Labour governments; the wage-reductions were largely neutral. Recovery to a reasonable degree of prosperity must be slow and will depend on a large improvement in the prices of wool and wheat and on a rational revival of overseas borrowing.

Altogether this is an excellent book.

H. W. M.

12.—*The Foundations of Agricultural Economics, together with an Economic History of British Agriculture during and after the Great War.* By J. A. Venn, Litt.D. Cambridge University Press. Second Edition, 1933. $9\frac{1}{2}'' \times 6\frac{1}{2}''$; 660 pp. + 20 plates and 24 maps and diagrams. 25s.

This enlarged edition of Dr. Venn's survey provides an eminently readable account of the history and development of questions such as tithe, land tenure and taxation, agricultural labour, marketing, co-operation, the wheat supply, and forestry. Much of the original matter has been rewritten and brought up to date by the inclusion of information as to the legislative and economic changes which have occurred in the ten years since the first edition was issued, while there are seven entirely new chapters. It thus forms a welcome addition to recent books on agricultural problems.

In dealing with Agricultural Statistics, Dr. Venn devotes a good deal of space to a discussion of the accuracy of the system of crop estimating and forecasting adopted in Great Britain. Here he repeats the criticisms originally made in an article in the *Economic Journal* and subsequently examined in a paper read by Mr. H. D. Vigor, before this Society (*Journal*, Part I, 1928). Briefly, his contention is that the Crop Reporters employed by the Ministry of Agriculture during the past forty years have persistently underestimated the yields of the principal crops, and have thus failed to record adequately the advances in English husbandry. This view is based to a large extent on the fact that the estimates in question have over a series of years fallen below the estimates made in a somewhat similar manner by *The Times*, the suggestion being that the official Crop Reporters are for some reason more pessimistic or conservative than the correspondents of the newspaper. Why this should be so, Dr. Venn does not explain, and as the persons concerned are in both cases practical agriculturists—farmers, landowners, valuers, etc.—it is not obvious why there should be a difference in outlook. One might with equal force argue that the unofficial Reporters had some inherent tendency to take an excessively favourable view of crop yields. Indeed, it has been suggested that *The Times* correspondents, being drawn mainly from the ranks of landowners and large farmers, were inclined to return yields representative of a rather better type of farming than the average of the country. However this may be, an explanation of the di-

vergence in results is perhaps more reasonably to be found in the fact that the methods of estimating are not precisely the same. The Ministry of Agriculture's Crop Reporters make separate estimates for each of the 11,000 parishes, and these are then weighted by the area of land under the respective crops in each parish. The correspondents of *The Times*, on the other hand, make estimates for very much larger and less closely defined areas, and of these estimates an arithmetical average is taken. The estimation of small areas adopted in the first case is certainly easier and more likely to be accurate than the other method, while the weighting by areas is also to be preferred. Whether Dr. Venn fully appreciates the difference between the two methods is not quite clear; in any case, he dismisses it as of no importance, and one cannot help feeling that his whole argument is based not so much on evidence which will bear critical examination as on a conviction that the improvements in English farming must necessarily have resulted in larger yields than those officially recorded. Individual crop estimates, depending as they do on human judgment, must always be liable to a wide margin of error, but Dr. Venn's suggestion that the official series have been permanently biased in one direction over a long series of years seems unreasonably hazardous. R. J. T.

13.—*To Be or Not To Be. A Study of Suicide.* By Louis I. Dublin, Ph.D., and Bessie Bunzel, M.A. New York: Harrison Smith and Robert Haas, 1933. 8½" × 5½"; x + 443 pp. \$3.50.

Because of the intricacies of the subject, the authors state, "it has been necessary to put severe limitations upon what we have attempted to do." In spite of such restrictions the reader is not likely to complain that the field they have endeavoured to cover is not wide enough. To begin with, their object has been to bring together the main statistics of suicide, using the official sources of many countries of the world supplemented for the United States by the full records of the Metropolitan Life Insurance Company. The statistical analysis of these data comprises such factors as the extent and trend of suicide, mainly since 1900, its race and colour incidence, its age and sex distribution, the methods employed, the effects of urbanization and economic conditions, its seasonal fluctuations and the influences upon it of war, religion and civil condition. To this modern picture an historical background is set in a discussion of suicide amongst primitive peoples, in Jewish history and in ancient Greece and Rome. From the students of religion and ethics the authors have sought to discover the teachings which tend to encourage or to prohibit suicide; from the legal literature they have traced "the manner in which prevailing sentiments and customs become crystallized in the law of nations." In a further section its bearings upon the practice of life insurance are discussed, and finally the psychological aspect and the influence of mental disease are enlarged upon. There is, therefore, no dearth either of material or discussion for the student who shares the enthusiasm of the authors for this "engrossing" and "fascinating" subject. Those who do not are likely to be somewhat deterred by the first chapter,

entitled, a little grandiloquently, "Case Studies," but in fact largely a résumé of newspaper stories which do not appear to be particularly illuminating. The statistician will find material more to his liking in the thirty-eight tables in the Appendix, carefully and clearly compiled, and the discussion of them in Chapters II to XI. This forms a very useful account of the basic data and of the factors related to them. Under existing mortality conditions the authors find that out of every thousand infants born in the United States 10 males and 3 females will eventually take their own lives. The rate has risen somewhat in the last few years, but on the other hand was in 1926-30 appreciably lower than in 1911-15. Of all the nationalities studied, they find the people of Ireland and Spain least given, and the countries populated by Germanic peoples most given to self-destruction (all the countries which in 1930 had the lowest suicide rates were those in which the Catholic faith predominates). Examination of the rates amongst the foreign-born and native white population in Pennsylvania and New York similarly shows that the natives of Germany have a rate far in excess of any other nationality and over twice as high as that of the native white population. The rate for negroes in the United States is low, and their presence affects favourably the national suicide mortality rate.

Analysis of the Metropolitan Life Insurance Company's data by age shows that between 1911 and 1931 the greatest improvement is apparent among adolescent girls, ages 15-19 years, whose rate in 1931 was approximately only one-quarter of that registered in 1911. Whereas the rates of females show very little change between ages 30 and the end of life, the males show a steadily rising rate, so that the discrepancy between the two sexes becomes more and more distinct with advancing age. For every age group among the males there has been a distinct decline in the rates from 1911 to 1920, while from 1920 to 1931 there is a sharp upward trend in all ages above 34. The citizens of the United States do not appear to be so addicted to coal-gas poisoning as those of this country, but, as might be expected, show a preference for fire-arms. Some of the spectacular cases quoted demand a little more substantiation; for instance, it is difficult to accept the case of "the young Parisian grisette who filled her small bedroom with flowers and was suffocated by their strong perfume."

Correlation of the suicide level with a business index showed an appreciable degree of relationship, of the order of -0.5 . The influence of war cannot easily be determined, for the relatively low rates recorded in the war period were followed by an appreciable rise in the post-war years of disorganization. These are some of the points elaborated and discussed in the statistical analysis. The historical and psychological sections it is hardly within the statistician's province to comment upon, and it is perhaps sufficient to say that both are interestingly written. A fairly extensive bibliography is given of the more important works that have been used in the preparation of the book.

A. B. H.

14.—Other New Publications.*

Fegiz (P. Luzzatto). La Dinamica delle Popolazioni. Trieste: R. Università degli Studi Economici e Commerciali, 1933. 6 $\frac{3}{4}$ " \times 9 $\frac{1}{2}$ "; 22 pp.

[In his inaugural lecture here reproduced (given at the University of Economic and Commercial Studies, Trieste), Professor Fegiz discusses theories of population movement. He briefly exposes and examines the theory of Differential Fertility, the Logistic Law, and Gini's theory of race evolution to maturity and retrogression to senility, corresponding with cyclical changes in the germ plasm analogous to those of the somatic cells in the lifetime of an individual. Professor Fegiz deprecates the acceptance of any of these theories as revealing a true law or as affording a solid basis for prediction. He points to the unforeseen intervention from time to time of economic and political catastrophes with which economic and psychological factors are plainly seen to be connected. As an illustration he takes the course of birth and death rates in Germany, beginning with the last pre-war quinquennium, and examines the fluctuations in detail and especially in relation to the population age grouping. Two diagrams show respectively the age constitution of the German population as it was in 1930, and as it may be expected to be, if no unforeseen disturbance occurs, in 1945. A full list of references to the authorities mentioned in the text is provided.]

Glesinger (Egon). Le Bois en Europe. Origines et étude de la crise actuelle. Préface par Jacob Viner. Paris: Recueil Sirey, 1932. 10" \times 6 $\frac{1}{2}$ "; xxxix + 742 pp. 80 fr.

[As Dr. Jacob Viner points out in his preface (an English translation is given), the data relating to forestry production are abundant, but not sufficiently complete, accurate, or uniformly compiled to permit of the discovery of principles or trends which have any great value, especially forecasting value. At the same time Dr. Glesinger has given an excellent historical record of the course of the timber trade in Northern Europe during the post-war period, and as such the book should prove very useful. The figures cover the years 1919–29, with some supplementary data for 1930, those of 1913 being provided for purposes of comparison. The first part of the book is concerned with the timber trade in Northern Europe as a whole, and includes figures of consumption, production, international trade, and prices. The latter and by far the larger portion of the book deals separately with the various countries entering into the trade: Great Britain, France, Belgium, Netherlands, Switzerland, Germany, Denmark, Norway, Sweden, Finland, Russia, Baltic States, Austria, Hungary, Czechoslovakia, and Poland. Dr. Glesinger suggests remedies for the present depression, but, as suggested by Dr. Viner, it is in the systematic record of ascertained facts that the value of the book chiefly consists. There are numerous tables and graphs and a bibliography.]

International Labour Office. Studies and Reports, Series B (Economic Conditions), No. 18. The Social Aspects of Rationalization. London: P. S. King, 1931. 6 $\frac{1}{4}$ " \times 9 $\frac{1}{4}$ "; vii + 381 pp. 8s.

[This publication is an excellent report, compiled from authoritative sources, on rationalization in practice. Methods of scientific management, standardization, and industrial research are shown to have been directly responsible for a significant increase in output. The effect of rationalization in general is given by reference to various industries. The statistics

* See also "Additions to Library," pp. 221 *et seq.*

showing the increased efficiency of coal-mining in certain European countries in recent years are particularly impressive. With respect to hours of work, the beneficial results of careful organization are made evident. Wages, employment (for which the statistical data are, however, inadequate), industrial hygiene, and the prevention of accidents are dealt with in turn, and the final chapter is devoted to rationalization in connection with industrial relationships.

It appears that rationalization has definitely brought about higher remuneration to the worker and, in addition, has improved real wages by providing a better quality article as the result of standardization. Even so, it is pointed out that an initial rise in wages is often desirable in order to encourage the worker to accept the new conditions. The majority of rationalization measures, it is concluded, almost necessarily involve a certain decrease in employment, but this appears to be only temporary in character. "Such unemployment may, therefore, be considered as the price of progress . . . a fresh argument in favour of the extension of the unemployment insurance."

A brief appendix entitled "Co-operative Methods of Rationalization" completes the study, which is comprehensive and contains a wealth of information on this particular phenomenon of modern industry. The data used appear to be reliable. It is a pity that no index is provided.]

Klein (Philip) and Voris (Ruth). Some basic statistics in social work, derived from data of family agencies in the City of New York. New York: For the New York School of Social Work by Columbia University Press (London: H. Milford), 1933. $8\frac{1}{2}'' \times 5\frac{1}{2}''$; xiv + 218 pp. 20s. 6d.

[A study of applicants for assistance to the Association for Improving the Condition of the Poor, the Catholic Charities of the Archdiocese of New York, the Charity Organization Society, and the Jewish Social Service Association in the Boroughs of Manhattan and the Bronx. Particular attention is paid to the merits of statistical units employed in measuring the work of such agencies and to the possibility of obtaining accurate and uniform statistics for small areas that can be related to other aspects of community life, economic conditions, etc.]

Papi (Giuseppe Ugo). Escape from Stagnation: an Essay on Business Fluctuations. London: P. S. King. 1933. $7\frac{1}{8}'' \times 4\frac{1}{2}''$; 165 pp. 6s.

[This study of trade cycles, by the Professor of Economics of the University of Pavia, is an amplification of articles contributed by him during the last two years to the *Giornale degli Economisti*, the *Riforma Sociale*, and the *Zeitschrift für Nationalökonomie*. His aim is to diagnose the fundamental cause of the cyclical movement and so arrive at the appropriate remedy. His conclusion is that, underlying the aggravations of post-war financial dislocation and other monetary factors, trade barriers of political origin, mechanical invention, and other conspicuous characteristics of the present time, the essential and persisting cause of alternating periods of rise and fall is miscalculation on the part of entrepreneurs. The ascending phase is usually initiated by the entrance into some kind of production of some factor favourable to profit, say, an invention which cheapens production, or a change in taste which creates a new demand. In subsequent stages, entrepreneurs make mistakes in estimating their exact costs and or the extent of the demand, and produce an absolutely or relatively excessive quantity of goods, and, overleaping the economic saddle, start the descending phase. Miscalculation now tends to bring about an under-supply; the depression is cumulative and persists until a new stimulant is applied. The effects of both kinds of miscalculation are, of course, exaggerated by banking operations and

other monetary factors. The errors themselves evidently have in part a psychological and emotional origin but are chiefly due to ignorance, that is, lack of information—to be precise, of statistical information; and Professor Papi can see no reason for supposing that they are engendered by anything inherent in the capitalist system of production. "We do not need a different system of production, but different men to deal with the situation." The first five chapters are analytical and expository; the sixth summarizes the author's conclusions, the seventh examines the recent explanations of Mr. Keynes and Professor Hayek. In the eighth and last, "Practical Conclusions," it is plainly asserted that during a depression all effort should be directed to the "continual curtailment in every possible way of the cost of production," not, however, primarily or necessarily by reductions of wages but essentially by improvements in the organization of production and of distribution. In short, he holds that the remedy lies in perfecting each part of the industrial apparatus rather than in smashing it and guessing again.]

Rau (B. Ramachandra), M.A., Ph.D. Banks and the Money Market. Calcutta: Lal Chand, 1933. 8½" × 5¼"; 257 pp. 2 Rupees.

[This book consists of four lectures which the author delivered to the Indian Institute of Bankers in the winter of 1930-31, and is intended as a companion to his three earlier publications dealing with Banking in India. The first three lectures are descriptive, and are elementary in character; the deficiencies of Indian money markets are constantly emphasized, and the fourth lecture contains suggestions for reform. The author pleads for organization, co-ordination, co-operation; for a Central Reserve Bank; for more elasticity, more control, and a reasoned monetary policy. The book is curiously arranged; the appendices, consisting of articles on related subjects by the same writer, occupy more than half of it: the index precedes the text. A brief bibliography is appositely headed "Books which may be read with Profit and Interest." There would be further profit in adding Dr. Walter Leaf's standard work on Banking.]

Spencer (Henry Russell), Ph.D. Government and Politics of Italy. London: Harrap, 1932. 7" × 4½"; 307 pp. 8s. 6d.

[This volume is one of a series of Government Handbooks prepared under the joint editorship of David P. Burrows, of the University of California, and Thomas H. Reed, of the University of Michigan, which are designed to give a clear picture of the administrative and political organization of the various countries dealt with. These, so far, have been Great Britain, Canada, Belgium, France, Germany, and Switzerland. If the present book is a representative sample, the series may be commended, although it is useful to statisticians only in so far as a right understanding of general conditions is essential to anyone who would draw correct inferences from numerical data. In this study the facts have evidently been ascertained with care, and set out impartially, but not aridly, with ample references and strictly fair comment. In order to place the present Italian régime and its political problems in their true perspective, the geographical background and preceding history have been sketched in. The first two chapters are on the Land and the People; the next section, "political conditions and forces," includes one on the Church, four on Fascism (origins, growth, opposition, organization), and one on the Press; Chapters XIV to XXII deal with government institutions, including the Corporative State, and the final chapter with external relations. The book is completed by a very useful chronicle of events (beginning with the Napoleonic occupation, 1796-1814, and ending with the general reduction of government salaries, December 1st, 1930), a full bibliography, and a good index.]

CURRENT NOTES.

On another page we give our usual table summarizing the overseas trade of the United Kingdom for the years 1932 and 1933. The excess of imports over exports of merchandize, which was £406,763,000 in 1931, declined in 1932 by about £121 million mainly as a result of the duties imposed under the Import Duties Act, and last year was further reduced by over £26 million to £259,346,000. Imports last year were valued at £675,847,000, being £25,823,000 (3·7 per cent.) less than in the preceding year. The greater part of this difference was due to the heavy importation of goods in February, 1932, in anticipation of the general tariff on March 1st, the total for that month being £21·1 million more than in February, 1933. For each month after April, except June, the value of imports last year was greater than a year earlier, the increase in the second half of the year amounting to £14·7 million and being due essentially to larger imports of raw materials. Though there was some increase in the price of these, notably raw wool, the total quantity of most of the important raw materials imported during the second half of the year was considerably greater than a year earlier.

The total value of exports in 1933 (£416,501,000) was, within a little, the same as in 1932, exports of British goods (£367,424,000) showing an increase of £2·4 million (0·7 per cent.) and re-exports a decrease of £1·9 million (3·8 per cent.). Though re-exports decreased, there was an increase in transshipments under bond amounting to £1·2 million, so that the aggregate value of the goods coming to this country but not retained for home consumption was approximately the same in the two years. With the exception of December, when the figures were affected by the five Sundays in the month, exports of British goods throughout the year 1933 showed an increasing tendency, as will be seen from the following figures: the increase in exports in September–October was partly seasonal.

Average export.	£ million.
January–February	28·6
March–April	29·3
May–June	29·6
July–August	30·4
September–October	33·2
November–December	32·4

Retained imports of food, drink and tobacco continued to decline in value, the total for last year being £29,273,000 (8 per cent.) less than in 1932, following a decline in that year of nearly £39 million compared with the preceding year. The decline in 1932 was mainly attributable to price changes, and while during the past year prices of imported food-stuffs have tended to increase, for the year as a whole there was a decline of 6 per cent. compared with 1932. The special duties imposed on cattle, etc. imported from the Irish Free State have had a considerable effect both in reducing the quantity imported and in lowering the average values of such imports. A noteworthy exception to the general fall in prices is bacon; though the quantity imported has declined by 20 per cent. consequent upon the quota arrangements, the value of the imports has fallen by less than one per cent. On the other hand, imports of chilled beef, which were also restricted, declined in quantity by only 7 per cent., but the total value declined by £3.3 million (18 per cent.). The total quantity of beef and of mutton and lamb imported was approximately the same last year as in 1932. Retained imports of wheat were larger, the imports from Australia being much larger than in any previous year, while those from Canada were nearly as high as in 1932. In the case of certain commodities, retained imports last year attained record dimensions; among these may be mentioned butter, cocoa and oranges, while imports of barley and tobacco were practically as high as in the record year, 1927 and 1929 respectively. Retained imports of tea and sugar were each about 13 per cent. smaller than the record figures for 1932, but the consumption figures showed comparatively small declines.

Though retained imports of manufactured articles were about £6 million less than in 1932, the reduction was wholly in the first quarter of the year, imports in each of the other quarters being greater than a year earlier; but the increase was not marked until the last quarter, when it amounted to £3.2 million. To a not inconsiderable extent this increase was due to larger imports of semi-manufactured goods or materials for industry, such as lead, zinc, leather, bricks and tiles, each of which showed a substantial increase in the second half of the year, but in certain cases enhanced prices led to the value of the imports being increased though there was no increase in the quantities imported—tin is a case in point. The duties on iron and steel had the effect of reducing imports to about 60 per cent. of those in 1932, the decrease being mainly in the first quarter. Imports of cotton piece goods were somewhat greater than in 1932—when they were heavily restricted in the

early part of the year by the 50 per cent. Abnormal Importation Duty—but were less than a quarter of those in 1931. Apart from artificial silk mixtures, which were likewise restricted, imports of other textiles were either smaller than in 1932 or showed no substantial change. A striking feature was the record quantity of refined petroleum imported, the retained imports during the past three years being 1,791, 1,808 and 2,018 million gallons, respectively; imports last year of both motor spirit and fuel oil were larger than in any preceding year.

The reduction in imports of manufactured articles led in 1932 to an increase in the imports of raw materials from which to manufacture articles to replace those formerly imported. This increase was continued in 1933, and accentuated during the second half of the year as a result to some extent of the increase in wholesale prices which followed the departure of the United States from the gold standard, such enhanced prices leading not only to higher values of the goods imported but to an increased demand for raw materials to replace stocks. There was further the demand arising from the tendency to expansion in exports. The result was that, in the second half of the year, retained imports of raw materials were £19·3 million (30 per cent.) more than a year earlier. Cotton imports were higher than in any year since 1929, while there was a continuance of the increase in sheep's and lambs' wool, the value of all wool imported and retained increasing by £2·4 million (11 per cent.). Retained imports of wood and timber, hides and skins, and rubber were much greater than in 1932, those of copra and mechanical wood pulp were larger than in any earlier year, those of flax and tow and of wet hides were larger than in any year since the War, and those of chemical wood pulp were practically as high as in the record year 1932. Imports of tin ore and of coconut oil, on the other hand, were very small, and linseed also showed a heavy reduction compared with 1932.

The quantity of coal exported last year, 39,068,000 tons, just exceeded the total for the preceding year, the decline in progress since 1929 being arrested in the last four months of the year; the increase since recorded may be attributed mainly to the trade agreements made with Germany and the Scandinavian countries about the middle of the year. The value of the coal exported constituted 8·6, 8·7 and 8·9 per cent. of the total value of British exports in 1933 and the two preceding years. Shipments of bunker coal declined further from 14,209,000 tons to 13,457,000 tons. There was some recovery during the year in iron and steel exports, these amounting to 1,922,000 tons in 1933 and 1,887,000 tons in 1932. Such exports were, however, less than half those in 1929. The

Board of Trade have calculated that adding together the value of the exports of iron and steel and manufactures thereof, "iron ore and scrap, cutlery, hardware, tools, machinery, and vehicles (except rubber tyres), the contribution to the total value of British exports was 19.1 per cent. in 1924, 23.9 per cent. in 1931, 22.1 per cent. in 1932 and 22.3 per cent. last year." There was a slight increase in the proportion for iron and steel alone, last year's figure of 8.1 per cent. comparing with 7.8 and 7.7 per cent. in 1931 and 1932, but with 9.3 per cent. in 1924. There was again a remarkable increase in exports of motor-cars and chassis, the exports last year (51,751) exceeding by 11,564 those during 1932 and being 9,740 in excess of the previous record year, 1929. Exports of machinery declined further by 8.6 per cent. to 275,100 tons, but exports of sugar-making and refining machinery constituted a record and there were also considerable increases in the exports of agricultural machinery and sewing machines. The value of the exports of cutlery, hardware, implements and instruments as well as of iron and steel and vehicles was greater last year than in 1932.

It is further stated in the *Board of Trade Journal* (January 18, 1934) that "in 1924 textile exports formed 38.9 per cent. of the total value of British exports, but this proportion has been lower in recent years, being 25.5 per cent. in 1931, 28.9 per cent. in 1932 and 28.7 per cent. in 1933. Cotton exports, which formed 25.1 per cent. of the total in 1924, fell to 14.6 per cent. in 1931, and a rise to 17.4 per cent. in 1932 was followed by a decline last year to 16.2 per cent. Exports of wool and manufactures thereof, which were 7.3 per cent. in 1931, formed a slightly higher proportion of the total (7.5 per cent.) in 1932, and this increased still further last year to 8.4 per cent.; this proportion was still, however, below that for 1924 (10.0 per cent.)." Exports of cotton yarns were slightly less in 1933 than in the previous year, and piece goods declined from 2,197 to 2,031 million square yards, the value of the exports of all descriptions of cotton manufactures declining by £3.9 million. The decline in exports of piece goods was largely due to India taking only 486 million square yards as against 599 million. There was also a marked decline in exports to the Far East, but exports to South America increased and those to South Africa were higher than in any earlier year. The improved position of woollen exports, as indicated by the above proportions, was general. Exports of British wool were higher than in any earlier year, exports of wool tops exceeded those of any post-war year, exports of yarns were higher than in any year since 1929, and exports of tissues and carpets were appreciably larger than in

either 1931 or 1932. There was generally an increase in other textile exports, and exports of linen piece goods exceeded those for any year since 1925. Exports of silk manufactures were an exception.

Among other goods, exports of rubber tyres for motor-cars and pedal cycles attained record dimensions and the quantity of tin exported was higher than in any year except 1929. The value of the exports of practically all non-ferrous metals was greater than in 1932, the aggregate increase being £5,255,000 and that of electrical goods and apparatus and of leather increased by about £900,000 and £800,000 respectively. Exports of chemicals, drugs, dyes and colours were more than maintained, but the value of apparel, of pottery, glass, abrasives, etc., and of paper, cardboard, etc., exported was appreciably less last year than in 1932.

Imports of bullion and specie were much higher in 1933 than in any preceding year, amounting to £262,039,000, as compared with the previous record total of £160,003,000 in 1932. Exports (£65,657,000) were much smaller than in the preceding two years. The inward balance last year was £196·5 million; in 1932 it amounted to £19·7 million. The movements of gold last year were very largely unconnected with merchandise trade, a considerable part of the inward balance consisting of gold held here on foreign account. The net imports were mainly from South Africa (£68·8 million), India (£33·9 million) and France (£30·5 million).

The calculations regarding the volume and value of our overseas trade in the *Board of Trade Journal* for January 25 show the variations in the quantities of goods imported and exported, eliminating the effect of price changes. The fall in average values which had been in progress since the autumn of 1929 was checked, the lowest point being reached for imports in the first quarter of the year, for British exports in the second quarter, and for re-exports in the last quarter of 1932. There was a rise of about 5 per cent. in average values of imports between the first and last quarters of the year, the increase being mainly due to enhanced prices of raw materials, but partly to an increase in respect of food-stuffs. For British exports there was little change in average values during the year. Retained imports showed the following changes in volume compared with a year earlier:—Food, drink and tobacco, — 1·9 per cent.; Raw materials, + 9·6 per cent.; Manufactured goods, + 2·9 per cent.; All articles, + 1·6 per cent. The volume of British exports, which increased in 1932 by 0·4 per cent., showed a further increase of 2·1 per cent. last year, the increase for manufactured goods being 3 per cent. and for raw materials 8 per cent.

Movements and Classes.	Twelve Months ended 31st December, 1932.	Twelve Months ended 31st December, 1933.	Increase (+) or Decrease (—).			
Imports, c.i.f.—	£'000.	£'000.	£'000.			
Food, drink and tobacco	372,941	340,599	(—) 32,342			
Raw materials and articles mainly un- manufactured	164,606	180,355	(+) 15,749			
Articles wholly or mainly manufac- tured	157,781	151,071	(—) 6,710			
Other articles	6,342	3,822	(—) 2,520			
Total Imports ...	701,670	675,847	(—) 25,823			
Exports, f.o.b.—						
<i>United Kingdom Produce and Manufactures—</i>						
Food, drink and tobacco	32,318	28,496	(—) 3,822			
Raw materials and articles mainly un- manufactured	43,608	45,989	(+) 2,381			
Articles wholly or mainly manufac- tured	275,556	280,441	(+) 4,885			
Other articles	13,542	12,497	(—) 1,045			
<i>Imported Merchandise—</i>						
Food, drink and tobacco	15,156	12,087	(—) 3,069			
Raw materials and articles mainly un- manufactured	23,722	25,650	(+) 1,928			
Articles wholly or mainly manufac- tured	11,826	11,109	(—) 717			
Other articles	317	232	(—) 85			
Total Exports ...	416,045	416,501	(+) 456			
Bullion and Specie—						
Imports	160,003	262,039	(+) 102,036			
Exports	140,308	65,657	(—) 74,651			
Movements of Shipping in the Foreign Trade—	Number of Vessels.	Thousand Net Tons.	Number of Vessels.	Thousand Net Tons.	Number of Vessels.	Thousand Net Tons.
<i>Entered with cargoes—</i>						
British	24,847	35,521	23,531	35,364	(—) 1,316	(—) 157
Foreign	22,959	23,848	23,748	25,064	(+) 789	(+) 1,216
Total entered ...	47,806	59,369	47,279	60,428	(—) 527	(+) 1,059
<i>Cleared with cargoes—</i>						
British	32,137	34,850	29,106	33,842	(—) 3,031	(—) 1,008
Foreign	18,932	20,591	20,075	21,795	(+) 1,143	(+) 1,204
Total cleared ...	51,069	55,441	49,181	55,637	(—) 1,888	(+) 196

As noted in the *Annual Statement of the Navigation and Shipping of the United Kingdom*, 1932, published at the end of November, the provisional figures relating to the number and tonnage of vessels entered and cleared with cargo in 1932 have been revised owing to the inclusion therewith of particulars relating to certain liners which called off Cowes to land or embark passengers and mails, such liners having previously been recorded incorrectly as entering or clearing "in ballast." This alteration, amounting to 3,308,938 tons net entered and 2,052,567 tons net cleared, affected chiefly German and United States vessels, but a small amount of Dutch and of British tonnage was also involved. The revised figures for 1932 have been published in the monthly "Accounts relating to Trade and Navigation" during 1933.

The general level of wholesale prices in 1933 as measured by the Board of Trade index-number showed on balance little change compared with 1932. The average of the numbers for the year was 84.5 (average in 1930 = 100) and for 1932 was 85.1. Food prices fell on balance 6.5 per cent. and prices of articles other than food rose 2.7 per cent. There were, however, some considerable fluctuations within the period, the index-number falling month by month from 84.5, in December, 1932, to 81.3 in April, 1933, and rising thereafter to 86.3 in September. There was a slight fall in October to 85.9, but for November and December, 1933, the number remained at 86.1, representing an increase as compared with December, 1932, of about 1.9 per cent.

The principal groups of articles, the prices of which showed a change as compared with 1932, were cereals, which declined 6.5 per cent., articles of food other than cereals and meat, which declined 13.1 per cent., and wool, which rose about 10.6 per cent. There was also some improvement in iron and steel prices, particularly during the latter half of the year. The most noticeable feature was the strong rise in the prices of wool and woollen materials, which have advanced over 40 per cent. since April, 1933. In one quality of tops the increase has been as much as 67 per cent. The prices of bacon have fluctuated violently during the year, and in December the price of Danish green sides was nearly 38 per cent. above prices ruling in January; in September prices had risen more than 50 per cent. compared with those of January and February. On the other hand, New Zealand cheese and butter have dropped during the year 17 and 15 per cent., and cocoa fell 22 per cent. Prices of sugar have fallen over 10 per cent., while the prices of Indian tea at the London Auctions were in December, 1933, nearly 70 per cent. above

the prices in the corresponding month of the previous year. The price of tin greatly advanced during 1933 and at the end of the year was rather less than 50 per cent. above the price at the end of December, 1932. Rubber has doubled in price since February, 1933.

The index-numbers since June, 1933, are given below.

Averages for 1930 = 100.

Period.	Total Food.	Total not Food.	All Articles.
July, 1933	80.1	88.8	85.6
August, 1933	81.8	88.1	85.8
September, 1933	82.9	88.2	86.3
October, 1933	82.0	88.2	85.9
November, 1933	82.1	88.3	86.1
December, 1933	81.4	88.7	86.1
Year 1933	81.6	86.1	84.5
Year 1932	87.3	83.8	85.1
„ 1931	88.0	86.7	87.2

The general level of wholesale prices in 1933 showed an advance of less than one per cent. in the prices ruling in 1913. Coal had advanced rather more than 22 per cent., the iron and steel group 5.8 per cent., meat and fish 7.1 per cent., articles of food other than cereals and meat 12 per cent., and the miscellaneous group of materials 1.4 per cent. The remaining groups of articles were lower in price than in 1913, textiles other than cotton and wool being as much as 26 per cent. below the prices of 1913, and non-ferrous metals 17.6 per cent.

As compared with 1924 the general level of prices in 1933 showed a fall of nearly 40 per cent., the Board of Trade index-number on the basis of the average prices in 1924 as 100, standing at 60.7.

The *Economist* index-number (1927 = 100), which in the first half of July stood as high as 65.9, had fallen by the end of November to 63.1, a drop of 4.2 per cent. It rose somewhat during December and at the end of the year stood about 4.6 per cent. above its position at the beginning of January, 1933 (63.9 as compared with 63.1). The rise was principally due to advances in the prices of textiles (wool), 9.7%, and minerals.

As measured by the *Statist* index-number the general level of wholesale prices in Great Britain rose during the first seven months of 1933 by rather more than 5 per cent. At the end of December, 1932, the number stood at 77.7 and at the end of July, 1933, at 81.7 (1866-77 = 100). From July onwards there was a slight but continued fall to November (79.3), with a slight recovery to 80.0 at the

end of December, at which date the index-number showed an advance of nearly 3 per cent. as compared with the end of 1932. The position of certain of the British index-numbers is compared below with those of the United States, France and Germany.

	Board of Trade (1930=100).	<i>Economist</i> (1927=100)	<i>Statist</i> (1866-77 = 100).	U.S.A. (Bureau of Labor) (1913=100).	France (<i>Stat. Gen.</i>) (1913=100).	Germany (<i>Stat.</i> <i>Reichsamt</i>) (1913=100).
July, 1933 ...	85.6	65.3	81.7	98.7	397	93.9
December, 1933 ...	86.1	63.9	80.0	102.0 *	389	96.0 *

* November, 1933.

There was an improvement in *shipping freights* during the last quarter of 1933 and the index-number compiled by the Chamber of Shipping showed an increase for December, 1933, of over 24 per cent. compared with the previous September. The average for the whole year 18.51 (1920 = 100) showed very little change as compared with 1932 (18.76) owing to the distinctly lower rates obtainable from February to May as compared with the corresponding period in 1932. The index-number for 1933 is lower indeed than in any year since 1920. The strong competition from foreign shipowners assisted by subsidies is still being severely felt.

There has been a considerable appreciation in the value of *Stock Exchange Securities* over the past year, although the rise was not quite so considerable as in 1932. The index-numbers of Stock Exchange Values published monthly in the *Bankers' Magazine* show an increase of about $7\frac{1}{2}$ per cent. at 16th December, 1933, over the figure for 17th December, 1932. The rise was greatest in the variable interest group, which showed an advance of 13 per cent., while the fixed interest securities advanced about 5 per cent. In 1932 the appreciation in these latter securities was as much as 13.5 per cent. The most notable advances during the year were in the Preference and Ordinary British Railway stocks included in the index-number, both of which rose by more than 100 per cent. The prices of Ordinary Railway stocks are still very low, representing not more than 28 per cent. of their par value. There has been some reaction in the values of variable interest securities since September, 1933, when the index-number stood at 113.5 (Dec. 1921 = 100), or higher than at any date since March, 1931.

As regards fixed-interest stocks the index-number was higher in

October and November, 1933, than in any other months during the period 1922-33.

The index-numbers for the period July to December, 1933, are given below.

	Fixed Interest Stocks.	Variable Dividend Securities.	Total.
July, 1933	117·9	111·7	115·9
August, 1933	120·1	112·4	117·6
September, 1933	121·2	113·5	118·7
October, 1933	122·3	110·4	118·4
November, 1933	122·3	107·7	117·6
December, 1933	122·0	108·4	117·6
<i>December, 1932</i>	<i>116·1</i>	<i>95·8</i>	<i>109·4</i>
„ <i>1931</i>	<i>102·2</i>	<i>90·7</i>	<i>98·5</i>
„ <i>1930</i>	<i>112·5</i>	<i>118·5</i>	<i>114·4</i>

The general level of *retail prices* in Great Britain of articles of working-class consumption as measured by the index-number of the Ministry of Labour showed no change at 1st January, 1934, as compared with the beginning of 1933. Prices of articles of food fell during the first five months of 1933 from 123 to 114 (prices at July 1914 = 100), but rose steadily up to the beginning of December to 126, falling away during the month to 124 at the beginning of January, 1934. There was a very slight rise in the index-number for rent (155 to 156), which started about April last. There was a slight rise in the price of tea and a very considerable rise (more than 20 per cent.) in the price of bacon. On the other hand, the prices of butter and cheese continued low and showed some decline. The index-numbers since June, 1933 (prices at July, 1914 = 100), are shown below.

	July 1933.	Aug. 1933.	Sept. 1933.	Oct. 1933.	Nov. 1933.	Dec. 1st, 1933.	Jan. 1st, 1934.
Food prices	118	119	122	123	126	126	124
All items (food, clothing, rent, fuel, etc.) ...	138	139	141	141	143	143	142
<i>All items (a year earlier)</i>	<i>143</i>	<i>141</i>	<i>141</i>	<i>143</i>	<i>143</i>	<i>143</i>	<i>142</i>

The following table gives, for the Overseas Dominions and the principal foreign countries, the percentage increases, in July, 1933, and on the latest available date, of the retail prices of food and other items as compared with the prices at July, 1914.

	Retail Prices of Food at		Retail Prices of All Items at		Date of Latest Return
	July, 1933.	Latest date available.	July, 1933.	Latest date available.	
Great Britain	Per cent. 18	Per cent. 24	Per cent. 38	Per cent. 42	1934. Jan. 1
<i>Overseas Dominions.</i>					
Australia... ..	18 *	17	—	16 †	1933. Oct.
Canada	— 5	— 1	20	22	Nov.
Irish Free State	29 *	40	49 *	56	Nov.
New Zealand	4	7	27	27	Nov.
South Africa	— 2	5	14	17	Nov.
<i>Foreign Countries.</i>					
Austria	4	4	5	6	Dec.
Belgium	—	—	595	600	Dec.
Czechoslovakia	6	2	2	1	Aug.
Denmark	17	21	60	62	Oct.
Egypt (Cairo)	1	— 1	24	21	Oct.
Finland	777	784	853	887	Nov.
France (Paris)	408	421	416 ‡	416 ‡	Dec.
Germany	11	13	19	20	Nov.
Italy	293	295	—	259 §	Nov.
Norway	32	30	48	47	Oct.
Sweden	23	23	53	54 ¶	Nov.
Switzerland	16	17	31	31	Nov.
United States	5	7	28 ||	28	Nov.

* August, 1933. † First Quarter, 1933. ‡ Figure for third quarter.
§ January–June, 1933. ¶ June, 1933. || October, 1933.

The returns relating to retail sales, which are prepared by the Association of Retail Distributors in conjunction with the Bank of England, show the relation of the total sales of each month to those of the corresponding month of the previous year: cumulative figures for the year are also given. In the latest return for the month of December, 1933, the total retail sales of all classes of merchandise, including foods, show an increase of over 4·1 per cent. in value over the sales for December, 1932, sales of food increasing 2·1 per cent. and sales of other merchandise 6·0 per cent. This is the third consecutive month in which an increase has been shown, and, with the exception of August, 1933, when there was also a slight increase, these are the only months since January, 1931, in which the statistics have shown a rise in the value of the total sales. So far as the figures can be tested by such information as is available for retail prices they point to an appreciable rise in the volume of retail sales during the last three months of 1933.

Over the eleven months February to December, 1933, the total volume of sales show a decline of but 0·3 per cent. as compared with

the corresponding period in 1932, articles of food showing a fall of 1·8 per cent. and other merchandise an increase of 1·8 per cent. Sales of food increased in value during November and December, 1933, for the first time in three years.

There was but a slight decline in 1933 in the average level of wage-rates in those industries for which statistics are available.* The estimated net weekly decrease in the rates of wages of the work-people affected by changes amounted to £66,000 (decreases £82,500, increases £16,500). In 1932 the net weekly decrease was about £249,000 and in 1931, £401,000. The principal trades affected by decreases were building, textile dyeing, bleaching and finishing, and clothing. In the building trades the reduction in wages amounted to $\frac{1}{2}d.$ per hour in the case of skilled workers, and in the case of unskilled workers the reduction varied from $\frac{1}{4}d.$ to $\frac{1}{2}d.$ per hour. The reduction in wages in the building industry covered about half a million workers in all the principal districts of Great Britain, and followed on a similar reduction in the early part of 1932. The wages of nearly 100,000 workers employed in steel melting shops and rolling mills in certain districts of England and Scotland who work under a sliding scale based on selling prices showed a net increase at the end of the year, and certain other steel and iron workers in the Midlands and blast furnacemen in Cleveland received increases. There was also an advance in wages to the employees in certain branches of the heavy chemical trades. It is estimated by the Ministry of Labour that the average decrease for all industries combined was equal to less than 1 per cent. of the wage-rates in operation at the beginning of the year.

There was little change in *hours of labour* during 1933, the total number of work-people affected amounting only to 13,500, of whom 11,000 experienced an average reduction of $3\frac{1}{2}$ hours per week and 2,500 an increase of about $1\frac{1}{4}$ hours per week. Apart from changes in the hours of labour of building operatives in 1922 and in 1923, and of coal-miners in 1926, 1930 and 1931, there have been very little alteration in working hours since the widespread reductions in 1919 and 1920.

The aggregate time lost owing to *trade disputes* in 1933 by work-people directly or indirectly involved at establishments where the disputes occurred was about 1,050,000 working days, or less than in any year for which comparative statistics are available, *i.e.* during the last forty years. The number of work-people involved

* The statistics are exclusive of changes affecting agricultural labourers, Government employees, domestic servants, shop assistants and clerks.

(136,000) was somewhat greater than the number in 1927 (108,000) and in 1928 (124,000), but the aggregate time lost was slightly less. Of the 136,000 work-people involved in 1933, over 70,000 were in the coal-mining industry and 27,000 in the transport trades; these two groups accounted for more than two-thirds of the total time lost. In the years of great coal-mining disputes, 1912, 1921 and 1926, the working days lost amounted to 41 millions, 86 millions and 162 millions respectively.

Unemployment in Great Britain and Northern Ireland in 1933 was slightly better than in 1931 and 1932, but was very severe generally and the mean rate of unemployment in the insured trades (19.9 per cent.) was not much below the rates (21.3 and 22.1 per cent.) for the two preceding years. There was, however, a fairly continuous improvement from the end of January, 1933, when the rate of unemployment (23.1 per cent.) was the highest ever recorded, until the end of December, when the rate was 17.6 per cent. Unemployment was least acute in London (11.8 per cent.) and South Eastern England (11.5 per cent.) and most acute in Wales (34.6 per cent.). In N.E. England, N.W. England and in Scotland the rates were 26.0, 23.5 and 26.1 per cent. respectively. Nearly all the principal industries showed some improvement, which was most marked on the whole in the metal and engineering trades generally. Unemployment, however, is still very severe in the heavy branches of the iron and steel industries, though it is in these branches that the improvement has, during the last few months, been most noticeable. Marine engineering, although improving, has still 40.2 per cent. of its work-people unemployed, consequent, no doubt, on the continued depression in shipbuilding, which remains the industry with the greatest proportion of its work-people unemployed (54.5 per cent.). Employment in the building trades and in the brick and tile trades has improved somewhat, but in the allied industry of public works contracting it has been very bad throughout the year. The textile industries all show an improvement as compared with the position a year ago, but employment remains depressed except in the woollen and worsted, carpet, artificial silk, and hosiery trades. Of all manufacturing trades employing over 100,000 work-people hosiery shows the lowest rate of unemployment (7.1 per cent.). On 23 Jan., 1933, the number of work-people (insured and uninsured) registered as unemployed in Great Britain at the Employment Exchanges of the Ministry of Labour was the highest ever recorded for Great Britain (2,903,065). Since that date there has been a decrease month by month except for a slight rise in July, and at the end of December, 1933, the number had fallen to 2,224,079, a

drop of nearly 500,000 as compared with December, 1932. The figures for the last six months are given below :—

	Wholly Unemployed.	Temporarily Stopped.	Persons normally in Casual Employment.	Total.
July 24, 1933 ...	1,855,214	501,702	85,259	2,442,175
August 21, 1933 ...	1,843,517	483,432	84,188	2,411,137
September 25, 1933 ...	1,857,064	393,517	86,146	2,336,727
October 23, 1933 ...	1,854,290	357,669	86,794	2,298,753
November 20, 1933 ...	1,855,808	340,135	84,074	2,280,017
December 18, 1933 ...	1,830,977	308,821	84,281	2,224,079
December 19, 1932 ...	2,171,175	454,522	97,590	2,723,287

According to official reports summarized in the Ministry of Labour *Gazette* unemployment in Germany decreased throughout 1933 except for a slight rise in the month of December, due principally to seasonal causes. The number reported by the Employment Exchanges as unemployed at the end of December, 1933, was 4,058,000, but it is pointed out that this number is not strictly comparable with the number reported at the end of 1932 (5,772,984), as it would not appear to include persons employed under voluntary labour service schemes who had applied for work at the Employment Exchanges. It is stated in the Ministry of Labour *Gazette* that "of 5,332,831 members of the German Labour Front covered by returns, 20·3 per cent. were wholly unemployed and a further 13·4 per cent. were working short time on 25 Nov. 1933; at the end of the previous month the corresponding percentages were 20·9 and 14·0."

In France the special monthly investigation covering numbers employed and hours worked in mining, industrial transport and commercial undertakings employing at least 100 workers shows that in the latter half of 1933 there was but little change as compared with corresponding months of 1932 in the numbers employed, the average decrease being less than 1 per cent. Since this return was instituted in 1931 there has, however, been no instance in which the figures have shown an improvement on the corresponding month of the previous year. The number of persons on the registers of Employment Exchanges at the end of 1933 was 343,460 as compared with 306,952 at the end of 1932, but the numbers registering are not a complete guide to the amount of unemployment.

Employment in Belgium has improved noticeably and at the end of September was considerably better than a year ago. Statistics from Approved Unemployment Societies with a membership of over a million record an unemployment of 13·8 per cent. at the end of

September, 1933, compared with 18.3 per cent. at the end of September, 1932, and 22.1 per cent. at the end of January, 1933.

Employment in Italy, which was worse in the first five months of 1933 than in 1932, improved considerably during the summer months, but there has since been a falling off and the numbers recorded as unemployed by the National Social Insurance Fund had increased to 1,066,215 at the end of November compared with 824,195 in July and 1,038,757 at the end of November, 1932. On balance there has been very little improvement on 1932.

Employment in the Scandinavian countries has been depressed during the whole of the year and except in Denmark show no marked improvement as compared with 1932. In the last named country, however, the rate of unemployment has dropped considerably since the end of 1932, when it was as high as 42.8 per cent. At the end of November, 1933, the rate had fallen to 25.7 per cent. as compared with 35.1 per cent. at the end of November, 1932.

In Czechoslovakia the numbers on the registers of Employment Exchanges in 1933 were greater than in the corresponding months of 1932, and in Poland, although employment has improved during the year, it is still worse than a year ago. In Austria, however, although employment is still depressed, there was some slight reduction in the numbers receiving unemployment benefit during October and November as compared with the corresponding months of 1932.

In the United States the increase in unemployment was arrested in April, 1933, and each month continued to show an improvement over the preceding month until November, when there was a slight falling off in the numbers employed in the principal manufacturing industries reporting to the Federal Bureau of Labor Statistics, and a somewhat greater falling off in the wages paid. It is officially estimated that, in 105 important manufacturing and non-manufacturing industries for which separate indexes of employment are compiled, two and a half million more persons were employed in November than in March, 1933. The index-number of employment in manufacturing industries at the end of November, 1933, was 71.4 compared with 59.4 in November, 1932, and 55.1 (the lowest point) in March, 1933 (average of 1926 = 100).

In Canada, although the index-number of employment for 1933 (83.3) shows no improvement on that for 1932 (87.5), there was an appreciable increase in employment during the latter months of the year, when the index-number of employment (average of 1926 = 100) had risen to 91.8 at the beginning of December, 1933, as compared with 83.2 at the beginning of December, 1932.

So far as can be judged from the statistics available, the im-

provement in employment in 1933, though visible in the United States and Great Britain, was scarcely appreciable in most countries, and the signs of permanent and continuous increase anywhere are none too apparent.

The prices of agricultural produce in England and Wales showed a gradual improvement in the second half of 1933, there being a rise of ten points in the monthly index-number between June and December. The average for the six months, July–December, was higher than that of the corresponding period of 1932 (106.5 against 103.1), though the average for the whole of 1933 was still below that of the previous year (107 against 112).

The following table gives the index-numbers published by the Ministry of Agriculture for each month, June–December, in the past three years (1911–13 = 100). The figures covering the months January–May were given in Part III, 1933, p. 528.

			June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1933	...	...	100	101	105	107	107	109	110
1932	...	...	111	106	105	104	100	101	103
1931	...	...	123	121	121	120	113	112	117

Wheat prices showed a rising tendency in the middle of 1933, when the highest figure for the year, viz. 6s. 10d. per cwt., was recorded. This improvement was not maintained, and in December the *Gazette* weekly average of British wheat was 4s. 5d. per cwt. as compared with 5s. 3d. in December 1932. These averages are based on actual market prices, but the effect of the Wheat Act, 1932, is to raise to 10s. per cwt. the total sum now received by the British grower for home-grown wheat. No allowance for this is made in the index-number, but the Minister of Agriculture recently stated that if account were taken of the "deficiency payments" under the Wheat Act, the figure of 109 for November, 1933, would be increased to 114, that is to a point above the corresponding figures both of 1932 and 1931. Of the other cereals, barley has generally realized higher prices since the last harvest, and the index-number of December, 1933, stood at 111 against 84 in the previous year. The figure for oats, however, was only 75 against 81 in December, 1932.

Beef cattle continued to sell at low rates throughout 1933. Efforts were made to raise prices by a restriction of imports, but up to the end of the year these appeared to have had little or no effect, the index-number for December being 97 against 101 in the same month of 1932. The prices of fat sheep and of both bacon and pork pigs, however, were all higher towards the close of the year.

The Board of Trade began, in the end of October, 1933, the publication of the Final Report on the Census of Production relating to the year 1930 with a volume (472 pp., price 7*s.*) covering the Textile, Leather, and Clothing Trades; it will be completed in four more volumes, including one dealing with the results of the Census as a whole. The preliminary reports issued in the course of 1933 gave for the several trades particulars of gross output, materials used, work given out, persons employed, and power used, and a final preliminary report gave data as to the consumption of fuel and electricity and the distribution of industry in the principal industrial areas. These reports have now been amended by the revision of certain returns and the receipt of others, in some cases to a considerable extent yet without modifying the net outputs seriously. In addition, "the final reports show for each trade the quantities of coal and coke consumed, the distribution of the trade in the chief industrial areas, a grouping of the results according to the size of the firms engaged, particulars of wages paid, and an estimate of the volume of production compared with the year 1924. Each report also includes particulars of the products of a given trade that were recorded by firms mainly concerned in other trades." In the Fourth Census, those firms which in Great Britain did not employ more than ten persons on the average, and in Northern Ireland those that did not employ more than five, were excluded. In most cases the results have not been substantially affected, but in certain industries, like dressmaking, baking, house decoration and maintenance, the deficiencies so caused are considerable, and to obtain a measure of the defect a statement is made for each trade showing the numbers of persons employed by small firms in 1924 and 1930 and the value of their output in 1924. Firms were also required, for the first time, to state the total quantity of electricity used in the year, distinguishing that generated in their own works from that purchased.

In the Textile Trades 1,062,250 persons were employed in 1930 as against 1,261,984 in 1924 (in both cases by firms employing more than ten persons in Great Britain and five in Northern Ireland), and the net output per head fell from £176 to £139, while the increase in mechanical power available was only 0·77 per cent.; only the Lace and Roofing Felts Trades as a whole showed an increase in net output per head. For the Leather Trades the decline in employment was from 48,429 to 46,146 persons, and in net output per head from £240 to £221, while mechanical power increased by 8·0 per cent. The Clothing Trades, on the other hand, showed an increased number of employees, from 473,968 to 492,124 (the tailoring, dressmaking, and millinery

trades growing by 26,234 and the boot and shoe trades declining by 8,839) and mechanical power increased by 9.5 per cent., but the net output per head fell off slightly, from £160 to £159. Net output per head in these two sections increased only in the Leather Goods Trade and in the Tailoring, etc. Trade and Boot and Shoe Trade (in this last case from £169 to £171). It may further be noted that net output per head declined in the Cotton Spinning Trade from £186 to £104, in Cotton Weaving from £133 to £118, in Woollen and Worsted Trades from £194 to £163, and in Silk, Linen, and Jute by very substantial amounts, thus disclosing the distressful state of the primary trades; in Cotton Spinning 241 out of 911 returns related to factories that were only open part of the year. The number of persons employed by small firms in all three groups of industries in 1924 was 96,339 and, if allowance is made for defective information regarding the Tailoring, etc., and Boot and Shoe Trades, may have been as much as 143,000 with an aggregate gross output, which we may estimate as having been perhaps about £34,000,000; in 1930 the number so recorded was 146,262 and may have been in reality 165,000. In order to enable comparison to be made between production in 1924 and 1930 the various items of output recorded by firms in Great Britain employing more than ten persons has been revalued at 1930 prices, and there is thus shown a reduction of 19 per cent. in the Textile Trades as a whole and an increase of 9 per cent. in the Clothing Trades; for the Leather Group, Fellmongery shows an increase of 7 per cent., Tanning, etc., a decrease of 8 per cent., and Leather Goods a reduction estimated at 7 per cent. Among the large groups of commodities, cotton yarns decreased by 21 per cent., cotton manufactures (except lace and ropes) 40 per cent., woollen and worsted 23 per cent., textile finishing 22 per cent., linen and hemp 22 per cent., and jute 21 per cent.; on the other hand, there was an increase of 145 per cent. in silk and artificial silk, 5 per cent. in hosiery, 10 per cent. in suits, dresses, etc., 6 per cent. in boots and shoes, and 15 per cent. in hats and caps. Further, estimates are made for each trade for the purpose of eliminating the duplication resulting from the rendering of returns by firms engaged in different stages of production, but the removal of duplication as between trades (*e.g.*, the use of yarns of cotton or wool in hosiery) is, apparently, reserved for the final volume of the Report.

For many students of economics the tables in which the particulars are re-classified according to the size of firm as measured by the average number of persons employed will be of special interest. In Cotton Spinning the highest net output per head (£138) was found

in firms employing 1000 and over, and the next (£128) in firms with 25-49 employees; in Cotton Weaving the order was 11-24, 25-49, and 50-99 and 1000 and over (equal); in the Wool Textile industry, 400-499, 300-399, and 200-299 and 750-999 (equal). In all textile trades except cotton the group 500-749 shows a smaller net output per head (due to a lower gross output and a higher cost of materials per head) than for the groups next larger and next smaller; this is especially marked in Hosiery, where the series runs:—400-499, £176; 500-749, £147; 750-999, £168. The Leather (Tanning and Dressing) Trades show little deviation from the average for the trade (£258) in the groups employing 25-49, 50-99, and 200-299 persons respectively, but in the group employing 11-24 the net output per head falls to £227 and in the group with 300 employees or more the average rises to £281. The Clothing Trades as a whole show the group with 1500 employees or more as the most successful, followed by the 11-24 group, and then by the 25-49 and 1000-1499 groups bracketed; the Tailoring and Dressmaking Trade, which furnishes nearly two-thirds of persons employed in the whole Clothing Industry, has the descending order 1000 employees and over, 11-24, 25-49, 50-99, while the Boot and Shoe Trade, contributing about a quarter of the total employees, has an even more complicated order (descending): 750-999, 11-24, 25-49 and 500-749, 1000 and over, 400-499. These vagaries may perhaps be in part explained on the hypothesis that they relate to independent and non-competitive subdivisions inside a trade, and it is to be hoped that some more light may be thrown on the problem in the final volume.

The Board of Trade was prohibited from requiring particulars of wages in connection with the Census of Production, but the Ministry of Labour simultaneously carried out a voluntary enquiry directed to the same firms which received the Census of Production schedules. The returns made covered firms responsible for 70·7 per cent. of the aggregate net output of the Textile Trades, 60·3 per cent. of that of the Leather Trades, and 56·9 per cent. of that for the Clothing Trades; these proportions are below those secured in 1924. Wages in 1930 averaged 58 per cent. of the net output in the Textile Trades, 46·7 per cent. in the Leather Trades, and 53·5 per cent. in the Clothing Trades; in 1924, the percentages were 50·4, 44·0, and 55·0 respectively. No conclusions are drawn officially, but it may be hazarded that wages have been more rigid than other components of net output, particularly profits, and with the net output per head generally declining the proportion of wages has naturally risen. In Cotton Spinning and Weaving, for example, the percentage which wages formed of net output rose from 54·5 to 70·6, and in Silk and Artificial Silk from 31·4 to 57·2, while in Hosiery, where, in the firms

making returns of wages, net output per head increased the percentage of wages fell from 52·6 to 49·5. These are only a few of the problems which this valuable volume contains, and we look forward to the successors which are expected to follow at relatively short intervals.

World Production and Prices, 1925-1932 (Geneva, 1933, 4s.) is the seventh number of the series known originally as *Memorandum on Production and Trade* and (in 1932) as *Review of World Production*. The topics it covers are only too familiar to us—the maintenance of food production, the heavy decline in the output of non-agricultural materials, the greater reduction in the manufacture of producers' goods than in that of consumers' goods, the increase of stocks, the fall in prices, the growing discrepancy between the prices of primary products and manufactured commodities, the maintenance of the prices of cartellized goods—but Mr. Loveday and his staff have tried to reduce the history of the period, and especially that of the years of the slump, to a numerical presentation. The dangers of such a procedure when it is extended to the whole world are obvious, for, as the authors say, the results "are based on statistics that are in some cases of doubtful comparability and seldom so comprehensive or so exact as to render it possible to draw conclusions of mathematical accuracy or incontrovertible finality from any single series of figures. For this reason, importance should be attached not so much to the absolute magnitude of this or that figure as to the direction towards which the whole mass of accumulated data tends to point." There are unfortunate omissions in the data which unquestionably affect the argument. Dairy produce and fruit are excluded from food-stuffs for lack of information regarding many countries: "no comprehensive figures of the production of food-stuffs exist for China"; there is an "absence of reliable statistics of agricultural production in the U.S.S.R." Timber is unavoidably omitted from raw materials, and everyone who has essayed the task knows how hard it is to frame estimates of wool production. In fact, one of the great troubles in almost all cases is the difficulty of ascertaining native consumption in countries producing primary products. "Information for 1932, moreover, is lacking with regard to the production of meat, tea, tobacco, vegetable oil materials, flax, hemp and wool, wood-pulp and most chemicals in a number of important producing countries." When we come to the manufacturing industries we are warned that "owing to the great diversity of the products of manufacture and the absence in most countries of periodical statistics covering total industrial production, it is, as a rule, impossible to secure an exact measure of the fluctuations in the physical output of industry over short periods of time. The

indices vary widely in composition and scope. . . . No close comparisons between the various national series can be attempted." The method adopted, of weighting the national indices by "a combination of the number of workers and the horse-power installed in the industries, supplemented by rough estimates, where possible, of the net value of industrial production," obviously depends for its reliability on the method of combination. In our own Censuses of Production manufacturers are required to return both the power equipment "ordinarily in use" and that "in reserve or idle," and it appears, to take cotton spinning and weaving as an example, that about 6.9 per cent. of the plant (prime movers and electric motors driven by purchased electricity) was idle in 1924 and about 5.8 per cent. in 1930. Clearly, though this is probably a counsel of perfection, "horse-power in use" should be substituted for "horse-power installed"; even then a clear measure is not obtained when intermittent working has been the practice, as was the case with very many firms in 1930. Finally, as is well known, indices of prices in different countries are not strictly comparable, and Mr. Flux, in his paper read before this Society on 20 June, 1933, dealt with some of the problems that arise when comparison is made.

The foregoing observations have not been made for the purpose of casting doubt on the work of the compilers of this volume. On the contrary, it is of the highest possible value alike in the calculation of indices and in the discussion of the production and prices of particular commodities. But they are intended to enforce the warning given in the beginning of the book. It is so very easy, as one sees from daily experience, for those who have not the inclination to follow in detail the carefully guarded results of statistical exploration to pick out a few salient figures and build upon them an argument which may be, in part or in whole, fallacious. Where this Report is rightly used, however, with regard rather to the continued movement of the data than to small increases or decreases over short periods, and when the figures are read alongside of the industrial history of the period, it will be found to be of the highest importance. Mr. Loveday and his colleagues have laid statisticians and men of business under many obligations, and their interpretative commentary on their own work is an admirable example of the use that can be made of the data which they have laboriously collected and skilfully reduced to a form admitting of comparisons.

The origin of the Factory Inspectorate is to be found in an Act of 1833, "to regulate the Labour of Children and Young Persons in the Mills and Factories of the United Kingdom"; under this Act four

inspectors were appointed and invested with both judicial and executive powers. The year 1933 therefore marks the hundredth anniversary of the appointment of the first Government Inspectors of Factories. The original staff of four has meanwhile expanded to 246, the number of factories still continues to grow and the total number of premises now on the registers of the Department is well over a quarter of a million. The Chief Inspector of Factories, Mr. D. R. Wilson, has celebrated this centenary in a particularly interesting number, of his Annual Report for 1932 (Cmd. 4377, price 2s. net). To this, members of the staff have contributed a series of excellent short historical reviews of the development of the "functions and responsibilities imposed on this Department by progressive legislation," dealing with employment and hours of work, safety, health, welfare, truck, piecework particulars, homework, the Government Wool Disinfecting Station and the Home Office Industrial Museum. In all respects the century has seen great changes. In the field of safety, for instance, electrical power has increasingly supplanted other forms of mechanical power and has brought its own special dangers. In the field of health many new problems have arisen, such as those of occupational epithelioma and silicosis, while the old scourges of lead poisoning, phosphorus necrosis and anthrax, have largely been overcome. Welfare work is to a large extent a modern development. Craftsmanship has been increasingly replaced by repetitive work and machine-minding. The consequent changes in the work of the Inspectorate have not, however, in Mr. Wilson's opinion, reduced the difficulties of their tasks. He concludes that though "ignorance, prejudice and apathy on the part of employers have indeed largely gone, yet modern industry with its ever-growing complexity has tended to bring with it a stream of new and rapidly changing problems affecting the workers' health and safety, each with its special remedy to be found." This report provides an interesting account of some of these developments.

Following on the World Population Conference held at Geneva in 1927, there was formed the International Union for the Scientific Investigation of Population Problems with affiliated research committees in twelve of the leading countries of the world. The second general assembly of this Union was held in London in 1931 and its proceedings published under the title of "Problems of Population," edited by the General Secretary, Mr. Pitt-Rivers. In 1932 the Executive Committee of the Union decided to launch a journal to be devoted to population problems, entitled *Population*, and chose Dr. E. C. Rhodes to be its editor. The first number of this venture

was issued in June, 1933 (London, George Allen and Unwin, Ltd., price 2s. 6d. net), and contains a wide range of studies. After a preliminary survey by the editor of the quantitative and qualitative problems involved, the historical aspect is discussed by Professor Carr-Saunders, the biological aspects of migration by Professor Crew, the bio-anthropological approach by Mr. Pitt-Rivers, and a survey given by Professor Julian Huxley of data respecting animal populations. More specific studies are contributed by Colonel Sir Charles Close, who discusses the situation in South and East Asia, and the Rev. Père V. Fallon, who with regard to Belgium reaches the gloomy conclusion that "la population belge vieillit rapidement. Elle marche rapidement à la mort." The Journal also contains reviews and short notices of published papers. Students of economic and vital statistics will find much interesting discussion in this first issue.

It is both the duty and the pleasure of the editors of a statistical journal on the verge of its centenary to offer a very hearty welcome to Prof. P. C. Mahalanobis and his colleagues who have launched *Sankhyā*, the Indian Journal of Statistics. *Sankhyā* bears to the Indian Statistical Institute a somewhat similar relation to that subsisting between this *Journal* and the Royal Statistical Society, and its first part (June, 1933) reflects great credit on all responsible. The format, a quarto, is more convenient for the reproduction of tabular matter than our own octavo, while both type and diagrams are pleasing. The contents are well calculated to appeal to different statistical tastes—a very important point, as all editors know. Those who are primarily interested in the application of numerical methods to economic problems will be attracted by Mr. Sailendra Nath Sen and Dr. Haris Chandra Sinha's study of Indian Prices during the Depression. This study, based on data taken down to the end of 1932, sounded at least one note of optimism, viz. that "the depression although still bad is not getting worse." Those attracted by problems of educational psychology will turn to Prof. Mahalanobis's paper on the reliability of a group test of intelligence in Bengali; a careful piece of work which, by the addition of explanatory notes, the author has endeavoured to make more intelligible to psychologists or administrators interested in the subject-matter but unfamiliar with statistical methods. Anthropologists will be interested in Mr. T. J. V. Roxburgh's paper on Galton's work on the evidential value of finger-prints and in Prof. Mahalanobis's revision of some of Risley's anthropometric data. Messrs. Poornapregna, Sastry and Madhava contribute a paper on maternity

statistics of interest both to the anthropological and the medical reader. Finally, Prof. Mahalanobis describes Drs. Egon Pearson and J. Neyman's methods of testing the three hypotheses: (1) That samples belong to normal populations having the same mean and standard deviation. (2) That the normal populations have the same standard deviation but that it is immaterial whether the means are identical. (3) That the means are approximately equal and also the standard deviations. The three criteria proposed by Pearson and Neyman are called L_0 , L_1 and L_2 , and Prof. Mahalanobis provides tables facilitating their computation and various examples.

The editorial committee have set themselves a high standard. Their colleagues in London will watch the progress of *Sankhyā* with hopeful interest.

The fourth Annual Report on Research issued by the Board of Directors of the Milbank Memorial Fund contains a brief catalogue of the research work which is now being conducted on behalf of the Fund, and collected reprints of twenty publications which appeared in various journals (mainly the Milbank Memorial Fund Quarterly Bulletin) in 1932. Amongst these papers are two investigations of the incidence of physical impairments in adult life and some half-dozen studies of problems of population, the latter being mainly directed towards fertility and social status, but also including Professor Pearl's study of "contraception and fertility in 2000 Women," previously printed in *Human Biology*. Under epidemiology and vital statistics Dr. Sydenstricker discusses the statistics of morbidity, and accounts are given of two epidemics of whooping cough and a mild dysentery-like disease observed in Cattaraugus County in 1930. Other studies deal with problems of rural hygiene, water supplies, public health nursing and the treatment of syphilis. Work at present being supported by the Fund includes intensive studies in the prevention of tuberculosis in industry, especially in the dusty trades, and investigation of the value of B.C.G., the decline of infant mortality, and diphtheria prevalence.

Last October there died Mr. Richard R. Mabson who was a Fellow of this Society since 1875. He was associated with the *Statist* from 1880 and retired as joint editor in 1917. That paper said of him in its issue of 7 October, 1933:—"It was as an authority on mining finance that Mr. Mabson was widely recognized. A specialist in statistics, he turned his attention to mining and exploration enterprise in the early days of its development in South Africa. . . . Mr. Mabson set out to lessen the risks of investment to the mining investor, and this he largely succeeded in doing."

OBITUARY.

SIR EDGAR HARPER.

SIR EDGAR HARPER died on 22nd January, 1934, aged 74. His official life began in 1878 with the Metropolitan Board of Works, from whose service he passed in 1889 to that of its successor the London County Council. In 1891, he was appointed Assistant Valuer to the Council, he succeeded Sir Laurence Gomme as Statistical Officer in 1901 and in 1911 took the bold step of resigning from the Council's service in order to be free to sit as a member of the Departmental Committee on Local Taxation. Soon afterwards he was appointed Chief Valuer in the Valuation Department, Inland Revenue, from which he retired on reaching the age limit in 1925. He received the honour of knighthood in 1920.

Elected a Fellow of the Society in 1901, he was a member of the Council for three periods, 1907 to 1913, 1917 to 1922, and 1925 to 1930; and his expert knowledge of property and taxation matters was always at the disposal of the Council. The papers which he read before the Society related to "London Traffic" (1904) and the "Basis of Local Taxation" (1918), two of the various subjects with which as Statistical Officer of the London County Council he had to deal during a period of great local government activity. As a witness before Royal Commissions and Parliamentary Committees he was remarkably successful, possessing natural insight and facility of expression, combined with clarity and thoroughness in his presentation of evidence. His interest in the taxation of site values amounted to an enthusiasm.

STATISTICAL AND ECONOMIC ARTICLES IN RECENT PERIODICALS.

UNITED KINGDOM—

Bankers' Magazine—

November, 1933—The progress of banking in Great Britain and Ireland during 1932. This price-raising policy: *Frank Morris*. Why gold must be restored as the world economic controller: *A. H. Gibson*.

December, 1933—The place of the banking system in the nation's economic life: *W. F. Crick*.

January, 1934—The banking year. Inflation and America: *A. J. Liversedge*.

Biometrika, December, 1933—On the likelihood that one unknown probability exceeds another in view of the evidence of two samples: *W. R. Thompson*. Methods of statistical analysis appropriate for k samples of two variables: *E. S. Pearson* and *S. S. Wilks*. On a method of determining whether a sample of size n supposed to have been drawn from a parent population having a known probability integral has probably been drawn at random: *Karl Pearson*. The distribution of β_2 in samples of four from a normal universe: *A. T. McKay*. A note on the distribution of range in samples of n : *A. T. McKay* and *E. S. Pearson*. On a recurrence relation connected with the Double Bessel Function $K_{\tau_1, \tau_2}(x)$ and $T_{\tau_1, \tau_2}(x)$: *Constance M. Rigby*.

East India Association, Journal—

October, 1933—The White Paper: a middle view: *The Rt. Hon. Lord Meston*.

January, 1934—India's Prosperity: *Sir M. de P. Webb*. The Lancashire textile mission to India: *S. S. Hammersley*.

Economic Journal, December, 1933—The gold standard: *Professor J. H. Jones*. Professor Pigou's method for deriving demand curves: *J. M. Cassels*, with a note by *A. C. Pigou*. The problems of a socialist economy: *M. Dobb*. The period of production and industrial fluctuations: *Martin Hill*. The concept of the length of the period of production: *C. H. P. Gifford*. The economic legislation of the United States, 1933: *Professor S. E. Harris*.

Economica, November, 1933—On the subject-matter and method of economic science: *Felix Kaufmann*. Under-consumption: an exposition by *J. A. Hobson*, with a reply by *E. F. M. Durbin*.

Eugenics Review, January, 1934—Amentia in the East African: *H. L. Gordon*. Inheritance of acquired characters: *A. F. Dufton*.

UNITED KINGDOM—*Contd.*

Human Factor, November, 1933—A psychological approach to market research : *N. M. Balchin*.

Institute of Actuaries, Journal, Part III, 1933—A review of investment principles and practice : *William Penman*. On factorial nomenclature and notation : *A. C. Aitken*. A practical experiment with frequencies and probabilities : *W. H. Carter*.

Lloyds Bank Monthly Review—

November, 1933—Economic adjustment in Australia : *D. Copland*.

December, 1933—The American experiment and its consequences : *Frederic Jenny*.

January, 1934—The financial press : *O. R. Hobson*.

Manchester Statistical Society, Transactions—

Session 1930-31—Recent changes in the overseas trade of the United Kingdom : *Professor G. W. Daniels*. French monetary policy : *R. G. Hawtrev*. The world's oil industry, 1920-30 : *C. A. Cooke*.

Session 1931-32—The national electricity scheme : *Ald. W. Walker*. The citizen's purse : *W. H. Coates*. A statistical study of the economics of large-scale production : *J. Jewkes*. The future of the gold standard : *Professor T. E. Gregory*. The financing of industrial enterprise : *Henry Clay*.

Session 1932-33—Ottawa and international trade : *H. Glyn Hughes*. Statistics of broadcasting : *E. W. Liveing*. The economics of road transport, illustrated by statistics relating to Lancashire : *J. Stafford*. The mobility of labour and the localisation of industry : *J. Jewkes*.

Midland Bank Monthly Review, November-December, 1933—The Bank for International Settlements: early years and later prospects.

Population, June, 1933—An outline of population history : *Professor A. M. Carr-Saunders*. A survey of data respecting animal populations : *Professor Julian Huxley*. The biological aspects of migration : *Professor F. A. E. Crew*.

Quarterly Journal of Mathematics, December, 1933—Mean-value theorems and the Riemann Zeta-Function : *A. E. Ingham*. Integrals for the product of two Bessel Functions (II) : *A. L. Dixon and W. L. Ferrar*.

Review of Economic Studies, October, 1933—Pareto and pure economics : *Umberto Ricci*. The theory of money and the analysis of output : *Joan Robinson*. Some notes on monetary theories of the trade cycle : *G. L. S. Shackle*. The diagrammatical representation of elasticity of demand : *A. P. Lerner*. Taxation and returns : *Lindley M. Fraser*.

UNITED KINGDOM—Contd.

Royal Meteorological Society, Quarterly Journal, January, 1934—The exceptional summer of 1933: *J. Glasspoole and W. L. Andrew.*

Royal Society, Proceedings, Series A, Vol. 141, No. 845, 1933—Probability and chance in the theory of statistics: *M. S. Bartlett.*

Royal Society of Arts, Journal, November, 1933—The census of India, 1931: marital conditions, caste and race: *J. H. Hutton.*

Statistical and Social Inquiry Society of Ireland, Journal, Session 1932-33—Capitalism and crises: *J. P. Colbert.* Some causes and consequences of the low Irish marriage rate: *James Meenan.* The organisation of official statistics in Saorstát Eireann and in some other countries: *Stanley Lyon.* The growth of electricity supply and its relations to civilisation: *Eoghan O'Brien.* The national expenditure of the Irish Free State in 1926: *T. J. Kiernan.*

Westminster Bank Review, December, 1933—Raw materials in depression and recovery.

AUSTRALIA—

Economic Record, December, 1933—A business index for Australia: *E. K. Heath and J. Polglaze.* Taxable capacity: *L. F. Giblin.* The third census of the Commonwealth of Australia: *H. C. Green.* The Australian balance of payments: *L. F. Giblin.*

INDIA—

Indian Journal of Economics, October, 1933—Population pressure and the migration problem in Asia: *R. K. Mukerjee.* A stable standard of value: *B. N. Kaul.* The Indian currency standard: *B. R. Shenoy.*

Sankhyā Indian Journal of Statistics, June, 1933—Indian prices during the depression: *Sailendranath Sen and H. C. Sinha.* Studies in educational tests, No. 1. The reliability of a group test of intelligence in Bengali: *P. C. Mahalanobis.* Galton's work on the evidential value of finger-prints: *T. J. Y. Roxburgh.*

UNION OF SOUTH AFRICA—

South African Journal of Economics, December, 1933—Some aspects of railway development in Natal: *W. J. Busschau.* Problems of racial adaptation: two articles by *J. E. Holloway* and *H. H. Pollack.*

UNITED STATES—

American Academy of Political and Social Science, Annals—
November, 1933—Social insurance (Whole number).

January, 1934—Banking and transportation problems (Whole number).

UNITED STATES—Contd.

American Economic Review, December, 1933—Banking Act of 1933: *Howard H. Preston*. British Exchange Equalization Account: *Alzada Comstock*. Applied Marxism in Soviet Russia: *Gustavus Tuckerman, Jr.* Speculation and growing instability of stock prices: *M. J. Fields*. "Mr. Keynes's control scheme": *J. M. Keynes*.

American Statistical Association, Journal—

September, 1933—A discussion of the accuracy of agricultural census enumeration in the north-east: *I. G. Davis*. The allocation of highway costs among classes of motor vehicles for purposes of calculating graduated tax schedules: *Arch. D. Schultz*. Tests of significance in applying Westergaard's method of expected cases to sociological data: *S. A. Stouffer* and *Clark Tibbitts*. Secondary curves as a measure of the lag or phase difference between two primary curves: *R. von Huhn*.

December, 1933—A social-economic grouping of the gainful workers of the United States: *Alba M. Edwards*. A statistical method for estimating the distribution of sizes of completed fraternities in a population represented by a random sampling of individuals: *Barbara S. Burks*. Karl Pearson and mathematical statistics: *Burton H. Camp*. Criteria of differential mortality: *Harold F. Dorn* and *Samuel A. Stouffer*. Predicting relief case loads for Minneapolis by empirical procedures, 1932-33: *F. Stuart Chapin*, *Ernst Jacobson* and *Sarah Stone*.

Econometrica, January, 1934—Annual survey of significant developments in general economic theory: *J. Tinbergen*. Maximum production studied in a simplified economic system: *Griffith C. Evans*. Demand functions and utility functions: a critical examination of their meaning: *E. H. Phelps Brown*. The reaction of consumers to changes in prices and income: a quantitative study in immigrants' behaviour: *Hans Staehle*. Theoretical studies of demand: *C. F. Roos*. Econometric parameters in a stationary society with monetary circulation: *J. Marschak*.

Harvard Business Review, January, 1934—Six months of the N.R.A.: *Donald R. Richberg*. England and America off gold—parallels and contrasts: *Malcolm P. McNair*. Population growth, consumer demand and business profits: *J. J. Spengler*.

Journal of Political Economy, December, 1933—The Banking Act of 1933: *R. R. Westerfield*. Crisis and readjustment in New Zealand: *H. Belshaw*.

Milbank Memorial Fund Quarterly Bulletin, October, 1933—Health and the depression: *Edgar Sydenstricker*. Nutrition and the depression: *C. V. Kiser* and *R. K. Stix*.

Monthly Labor Review, November, 1933—Occupational changes since 1850, as shown by census reports.

UNITED STATES—*Contd.*

Quarterly Journal of Economics, November, 1933—Industrial productivity in Great Britain and the United States: *A. W. Flux*. Money, prices and production: some fundamental concepts: *J. W. Angell*. Money, gold, and income in the United States, 1921–32: *Lauchlin Currie*.

Review of Economic Statistics—

November, 1933—Review of the third quarter of 1933: *W. L. Crum* and *J. B. Hubbard*. Timing of recovery from major depression: *Stephen Heard* and *Alan F. Beede*.

January, 1934—General economic conditions in the United States: Editorial. British and French economic conditions (communicated). Prices and production at home and abroad (Editorial). Gold and the general price level: *Rufus S. Tucker*.

Wheat Studies of the Food Research Institute, Stanford University—

November, 1933—Price leadership and interaction among major wheat futures markets.

December, 1933—The world wheat situation, 1932–33.

ARGENTINA—

Revista de Ciencias Económicas, September, 1933—Un experimento social en Estados Unidos: *Alejandro M. Unsain*. La eliminación del lucro como objetivo fundamental del cooperativismo: *Esteban Balay*.

BELGIUM—

Bulletin de l'Institut des Sciences Économiques, November, 1933—Indices de la consommation en Belgique de 1897 à 1933: *Léon H. Dupriez* and *Maurice Borboux*. L'évolution économique de la sidérurgie belge de 1830 à 1913: *Amé Wibail*. Les finances de l'état et la conjoncture en Belgique de 1830 à 1913: *Pierre van Rest*.

DENMARK—

Nationaløkonomisk Tidsskrift—

Hefte 4, 1933—Likvid Kapital: *Jens Warming*. Er det almindelige Prisniveau en Fiktion?: *Nils Lindberg*, *Jørgen Pedersen*, and *H. C. Nybølle*. Befolkningsskylningen i England: *John Knox*.

Hefte 5, 1933—Nordslesvigs Befolkning 1864–1920: *Mads Iversen*. Likvid Kapital: *Jens Warming*. Handelspolitiske Perspektiver efter den økonomiske Verdenskonference i London: *J. C. Jørgensen*.

Hefte 6, 1933—Industrikonjunkturerne og Kornpriserne: *Jørgen Pedersen*.

FRANCE—

Bulletin de la Statistique Générale de la France, October–December, 1933—L'automobile en France depuis la guerre (suite et fin) : *Alfred Sauvy.*

Journal des Économistes—

November, 1933—L'industrie sidérurgique et les constructions métalliques : *R. J. Pierre.*

December, 1933—La situation budgétaire française fin 1933 : *Édouard Payen.* L'Italie économique : *R. J. Pierre.*

January, 1934—L'industrie lainière : *R. J. Pierre.* L'héritage recueilli par 1934 : *Édouard Payen.*

Journal de la Société de Statistique de Paris—

December, 1933—Les variations du taux de l'escompte et les récents événements monétaires : *P. Cauboue.*

January, 1934—Les conditions dans lesquelles vivent et circulent en France les valeurs mobilières : *A. Gauthier-Nugue.*

Rerue d'Économie Politique, September–October, 1933—Économie corporative et système capitaliste (à suivre) : *François Perroux.* La semaine de quarante heures : *Gaston Leduc.* Le bloc des états agricoles de l'Europe centrale et orientale et son programme : *Albert Bussot.* La vie économique en Grande-Bretagne : *Henri Pouyanne.*

GERMANY—

Blätter für Versicherungs-Mathematik, January, 1934—Versicherung und Lotterie : *Paul Riebesell.* Anwartschaftswerte in der Invalidenversicherung : *Berthold Heinicke.*

Deutsches Statistisches Zentralblatt, October–November, 1933—Die Korrektur der Ziffern von Sterblichkeit, Geburtlichkeit und Geborenenüberschuss : *Karl Freudenberg.*

Vierteljahrshefte zur Konjunkturforschung, Heft 3, 1934—

Teil A—Die Konjunktur im Winter 1933–34.

Teil B—Die Konjunktur einzelner Wirtschaftszweige. Wirtschaftszahlen des In- und Auslands.

Weltwirtschaftliches Archiv—

October, 1933—Die Weltkonferenz in London 1933 : *J. Coatman.* Die Tendenz zur Nationalwirtschaft und die internationalen Beziehungen : *Lucien Brocard.* Die Weltwirtschaftskrisis des Jahres 1857 : *Hermann Wätjen.* Die Zoll- und handelspolitischen Auswirkungen der Weltwirtschaftskrisis von 1857–1859 : *Hans Rosenberg.*

Erganzungsheft 5, 1933—Der Hafen von Vlissingen. Seine Stellung und Entwicklungsaussichten im internationalen Verkehr : *Erich A. Kautz.*

Zeitschrift für die Gesamte Versicherungs-Wissenschaft—

Heft 4, 1933—Lebensversicherungsfragen im Lichte neuerer Gesetzgebungen : *Otto Hagen.* Die Sozialversicherung im faschistischen Italien : *L. Richter.*

Heft 1, 1934—Die Konjunkturabhängigkeit der Feuerversicherung : *Werner Mahr.*

ITALY—

Annali di Economia, December, 1933—Il sistema di banca continentale e quello inglese nell'anteguerra: *Publio Mengarini*. Giuseppe Prato, maestro di storia economica: *Anselmo Bernardino*. Il credito di accettazione: *Giulio Capodaglio*.

Giornale degli Economisti—

September, 1933—Indirizzi di pensiero politico-economico nel risorgimento italiano: *A. G. Canina*. L'imputazione dell'interesse figurativo al "costo monetario dell'uomo": *Tommaso Zerbi*. Sulla distribuzione dei terreni agrari nel Giappone dal 1908 al 1930: *M. Hayakawa*.

November, 1933—Considerazioni intorno alla teoria della domanda: *Valentino Dominedo*. Economia generale ed economia delle ricchezze: *Alberto Breglia*. Nuovi dati sulla natalità in Italia: *Giorgio Mortara*.

December, 1933—La crisi del dollaro: *G. del Vecchio*. I due tipi fondamentali di indagine nell'ambito dell'economia finanziaria: *Renzo Fubini*. Sui metodi per lo studio della fecondità dei matrimoni: *Giorgio Mortara*. Impressioni su alcuni aspetti dell'industria Britannica: *Carlo Pagni*.

Le Assicurazioni Sociali—

No. 3, 1933—La previdenza per gli impiegati privati: *Giuseppe Landi*. La diminuzione delle nascite: *F. Savorgnan*. La disoccupazione in Gran Bretagna nella ultima fase: *J. L. Cohen*. (A Supplement contains the first article in French, the others in English.)

Appendix to No. 3, 1933—Valutazione della capacità al lavoro nei minorati della vista: *G. Francioni*. L'assicurazione contro la disoccupazione in Italia nel mese di Marzo 1933—xi.

No. 4, 1933—Perfezionamenti alla mutualità operaia nel settore del lavoro industriale: *Ugo Clavenzani*. Un mezzo secolo di assicurazione sociale contro le malattie in Germania: *Alfred Manes*. (A Supplement contains these articles in French and English respectively.)

La Riforma Sociale, November–December, 1933—Trincee economiche e corporativismo: *L. Einaudi*. La moneta controllata e le sorprese dell'esperimento americano: *A. Cabiati*. Discussioni teoriche sull'imposta: *Umberto Ricci* and *Lionello Rossi*.

Rivista Italiana di Statistica, Economia e Finanza, December, 1933—L'azienda agraria tipica: *G. Medici*. Confronti internazionali tra prezzi delle merci e corsi delle azioni: *S. Vianelli*.

JAPAN—

Kyoto University Economic Review, July, 1933—Progressive taxation on the incomes of corporations: *Professor M. Kambe*. Survey of the distribution of the people's incomes in the light of the household rate: *Professor S. Shiomi*. On output-curtailing in modern industry: *I. Otsuka*. Marx's analysis of capitalism and the general equilibrium theory of the Lausanne School: *K. Shibata*.

SWEDEN—

Ekonomisk Tidskrift—

Häft 3, 1933—Sveriges Riksbanks Konsumtionsprisindex : *Erik Lindahl.*

Häft 4, 1933—Spridda studier angående stagnationens national-ekonomi : *David Davidson.*

INTERNATIONAL—

International Labour Review—

December, 1933—The economic experiment in the United States. Unemployment and national health in Great Britain. Food consumption of working-class families in certain countries.

January, 1934—The course of American recovery : *H. B. Butler.* Unemployment relief measures in New Zealand : *E. J. Riches.*

Revue de l'Institut International de Statistique—

Livr. 3, 1933—Der logische Grundcharakter der statistischen Zahlen : *F. Zizek.* (Summaries in French and English.) Quelques considérations sur la comparaison internationale des indices du coût de la vie et des salaires réels : *J. H. van Zanton.* (Summary in English.) Der Begriff des "Fremden" in der Fremdenverkehrsstatistik : *G. Thuring.* (Summaries in French and English.)

Livr. 4, 1933—New measurements of trade and of economic growth : *C. Snyder.* (Summary in French.) Sur le coefficient, dit de corrélation et sur la corrélation en général : *M. Fréchet.* (Summary in English.) XXIIe Session de l'Institut International de Statistique : *C. A. Verriijn-Stuart.*

LIST OF ADDITIONS TO THE LIBRARY.

Since the issue of Part IV, 1933, the Society has received the publications enumerated below :—

I.—OFFICIAL PUBLICATIONS.

(a) United Kingdom and its several Divisions.

United Kingdom—

Colonial Office. West Indies. Report of the Closer Union Commission (Leeward Islands, Windward Islands, Trinidad and Tobago), April 1933. Cmd. 4383. London: H.M.S.O., 1933. $9\frac{1}{2}'' \times 6''$; 46 pp. 1s.

Committee on Industrial Assurance and Assurance on the Lives of Children under Ten Years of Age. Report. Cmd. 4376. London: H.M.S.O., 1933. $9\frac{1}{2}'' \times 6''$; vi + 118 pp. 2s.

Education, Board of—

Handbook of suggestions on health education. London: H.M.S.O. 1933. 111 pp. 6d.

Statistics of urban public libraries in England and Wales (1931-32). London: H.M.S.O., 1933. $9\frac{1}{2}'' \times 6''$; 43 pp. 9d.

Empire Marketing Board—

Series E.M.B.

63. Empire Marketing Board, May 1932-May 1933. 127 pp. 1s.

64. Sisal, a note on the attributes of the fibre and their industrial significance. 78 pp. 1s.

65. Fruit supplies in 1932 (including vegetables, flowers and bulbs). 140 pp. 1s.

66. Dairy produce supplies (including poultry and pig products). 131 pp. 1s.

67. Report on the infestation of cured tobacco in London by the Cacao Moth *Ephestia Elutella* HB. 92 pp. 1s.

68. Palestine orange shipments. 56 pp. 1s.

69. Canned and dried fruit supplies in 1932. 139 pp. 1s.

70. The demand for South African deciduous fruits. 70 pp. 1s.

71. Coir. Report on the attributes and preparation of coconut fibre. 60 pp. 1s.

72. Banana storage: an account of recent investigations into the storage behaviour of several varieties. 35 pp. 1s.

Series E.M.B.(C).

6. Fibres: a summary of figures of production and trade relating to cotton, wool, hemp, flax, jute. 54 pp. 6d.

7. Fruit: a summary of figures of production and trade relating to apples, pears, bananas, citrus fruit, grapes, wine, raisins and currants. September, 1933. 49 pp. 6d. [London: H.M.S.O. $9\frac{1}{4}'' \times 7\frac{1}{2}''$.]

Forestry Commission—

Interim report of the Inter-Departmental Home-Grown Timber Committee, 1933. London: H.M.S.O., 1933. $9\frac{1}{4}'' \times 6\frac{1}{2}''$; 19 pp. 6d.

Furunculosis Committee. Second interim report (June 1933). Edinburgh: H.M.S.O., 1933. $9\frac{1}{2}'' \times 6''$; 81 pp. 2s. 6d.

General Register Office—

Census of England and Wales, 1931. Ecclesiastical areas (England). vi + 194 pp. 9s. Dorset (Part II). 14 pp. 9d. Hampshire (including the Isle of Wight) (Part II). 31 pp. 1s. 6d. Jersey, Guernsey and adjacent islands. xx + 36 pp. 2s. 6d. Worcester (Part II). 17 pp. 1s. [London: H.M.S.O., 1933. $13'' \times 8\frac{1}{2}''$.]

(a) **United Kingdom and its several Divisions—Contd.**

Health, Ministry of. Report of the Departmental Committee on Housing. London: H.M.S.O., 1933. 9 $\frac{1}{2}$ " \times 6"; 68 pp. 1s. 3d.

Home Office—

Departmental Committee on the Employment of Prisoners. Report. Part I. Employment of prisoners. London: H.M.S.O., 1933. 9 $\frac{1}{2}$ " \times 6"; 99 pp. 1s. 6d.

Departmental Committee on Compensation for Industrial Diseases. Second Report. London: H.M.S.O., 1933. 9 $\frac{1}{2}$ " \times 6"; 21 pp. 6d.

Imperial Committee on Economic Consultation and Co-operation, 1933. Report. London: H.M.S.O., 1933. 9 $\frac{1}{2}$ " \times 6"; 131 pp. 2s.

Industrial Health Research Board. Report No. 69. Incentives in repetitive work; a practical experiment in a factory, by S. Wyatt assisted by L. Frost and F. G. L. Stock. London: H.M.S.O., 1934. 9 $\frac{1}{2}$ " \times 6"; 67 pp. 1s. 3d.

Monetary and Economic Conference. Declaration by delegations of the British Commonwealth. Cmd. 4403. London: H.M.S.O., 1933. 9 $\frac{1}{2}$ " \times 6"; 5 pp. 1d.

Overseas Trade, Department of—

Reports: 553. Germany, June 1933. 166 pp. 4s. 6d. 554. Canada, 1932-33. 181 pp. 5s. 555. Roumania in 1932. 91 pp. 2s. 6d. 558. Italy, July 1933. 194 pp. 5s. 559. Iraq, August 1933. 50 pp. 1s. 6d. 560. Egypt, July 1933. 137 pp. 4s. 561. China, 1931-33, together with an annex on trading conditions in Manchuria. 173 pp. 4s. 9d. 562. French West Africa, 1931-33. 50 pp. 1s. 6d. 563. Belgian Congo, 82 pp. 2s. 6d. 564. Dominican Republic, and the Republic of Hayti, 64 pp. 2s. 3d.

[London: H.M.S.O., 1933. 9 $\frac{1}{2}$ " \times 6".]

Royal Commission on Lotteries and Betting, 1932-33—

Selection from statements and summary of gambling legislation in other countries. London: H.M.S.O., 1933. 13 $\frac{1}{4}$ " \times 8 $\frac{1}{4}$ "; 31 pp. 3s.

Final report. London: H.M.S.O., 1933. 9 $\frac{1}{2}$ " \times 6"; 183 pp. 3s.

Trade, Board of—

Committee on Gift Coupons and Trading Stamps. Report. London: H.M.S.O., 1933. 9 $\frac{1}{2}$ " \times 6"; 16 pp. 3d.

Final report of the Fourth Census of Production (1930). Part I. The textile trades, the leather trades, the clothing trades. London: H.M.S.O., 1933. 9 $\frac{1}{2}$ " \times 6"; 472 pp. 7s.

Transport, Ministry of—

Experimental work on roads; report for the year 1932 of the Technical Advisory Committee on Experimental Work. London: H.M.S.O., 1933. 9 $\frac{1}{2}$ " \times 6"; 75 pp. 1s. 6d.

Preliminary report on fatal road accidents which occurred during the six months ending 30th June, 1933. London: H.M.S.O., 1933. 9 $\frac{1}{2}$ " \times 6"; 30 pp. 6d.

Scotland—*Agriculture, Department of—*

Report on the marketing of grain and grass seed in Scotland. Wheat, barley, oats, grass seed. Edinburgh: H.M.S.O. 9 $\frac{1}{2}$ " \times 6"; 51 pp. 6d.

Third report on the profitability of farming in Scotland. The financial results obtained on certain groups of farms in Scotland in 1930-1. Edinburgh: H.M.S.O., 1933. 9 $\frac{1}{2}$ " \times 6"; 65 pp. 1s.

Health, Department of. Housing of the working classes—Scotland. Economically planned houses of satisfactory design. Plans and photographs. Edinburgh: H.M.S.O., 1933. 9 $\frac{1}{2}$ " \times 7 $\frac{1}{4}$ "; 27 pp. 1s.

Registrar-General. Census of Scotland, 1931. Vol. II. Populations, ages and conjugal conditions, birthplaces, Gaelic-speaking and housing. Edinburgh: H.M.S.O., 1933. 13 $\frac{1}{4}$ " \times 8 $\frac{1}{4}$ "; lvi + 222 pp. 13s.

(b) Dominions, Colonies, and Protectorates.

Australia—

Report of the fourth Australian Cancer Conference held at Canberra, March 1st-3rd, 1933. Canberra, 1933. 13 $\frac{1}{4}$ " \times 8 $\frac{1}{4}$ "; 84 pp.

Canada—*Dominion Bureau of Statistics—*

Sixth census of Canada, 1921. Vol. II. Population. Vol. III. Population. Vol. IV. Occupations. Vol. V. Agriculture.

[Ottawa: 1925-29. 9 $\frac{1}{2}$ " \times 6 $\frac{1}{2}$ "; 4 vols.]

Seventh census of Canada, 1931. Census Bulletins.

[Ottawa, 1933. 11" \times 8 $\frac{1}{2}$ "; 33 parts.]

Unemployment among wage-earners (Bulletins I-IX). Ottawa, 1933. 10" \times 6 $\frac{3}{4}$ ".

Manufacturing industries of Canada, 1931. Summary report. Ottawa, 1933. 8 $\frac{1}{4}$ " \times 6"; 112 pp.

Ontario. Sessional papers, Vol. LXII, Part III. First session of the eighteenth legislature of the Province of Ontario. Toronto, 1930. 9 $\frac{1}{4}$ " \times 6 $\frac{1}{2}$ "; 18 papers. (From Mr. Curwen.)

India—

Census of India, 1931. Vol. I. India. Part I. Report by J. H. Hutton, to which is annexed an actuarial report by L. S. V. Vaidyanathan. 518 pp. 15s. Part II. Imperial tables. 632 pp. 17s. 6d.

[Delhi: Manager of Publications, 1933. 13" \times 8 $\frac{1}{2}$ ".]

Irish Free State—*Industry and Commerce, Department of—*

Census of Production, 1931. (Preliminary figures.) Dublin, 1933. 13" \times 8"; 29 sheets typewritten.

Census of industrial production, 1931; quantities and values of goods produced. (Preliminary figures.) Dublin. 9 $\frac{1}{4}$ " \times 6 $\frac{1}{4}$ "; 8 pp. 2d.

Mauritius—

Final report on the census enumeration made in the Colony of Mauritius and its dependencies on April 26th, 1931. Port Louis, 1933. 13" \times 8"; 20 + lxiii pp.

Palestine—*Jewish Agency, Trade and Industry Department—*

Foreign trade of Palestine and other countries of the Middle East in 1930-31. Jerusalem, 1933. 13" \times 9 $\frac{1}{4}$ "; lxxx + 355 + 16 pp. £P. 1.

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REVENUE OF THE UNITED KINGDOM.

*Net Produce in Quarters of 1933, and in Financial Years ended
March 31, 1932-33, 1931-32, 1930-31, 1929-30.*

(000's omitted.)

QUARTERS, ended	March 31, 1933.	June 30, 1933.	Sept. 30, 1933.	Dec. 31, 1933.	Total for calendar year 1933.
	£	£	£	£	£
Customs	40,063	43,209	46,090	11,973	174,335
Excise	26,700	26,000	25,800	31,500	110,000
Stamps and Estate Duties ...	27,970	20,050	32,790	28,310	109,150
Land Tax and Mineral Rights Duty	580	130	50	30	790
Postal Service	17,600	17,050	17,550	19,800	72,000
Telegraph Service					
Telephone Service					
Property and Income Tax, including Super-Tax	112,913	106,139	122,280	124,613	465,275
	228,138	22,399	30,410	26,199	307,776
	341,351	128,838	152,720	151,112	771,051
Excess Profits Duties, etc. ...	2,200	—	—	—	2,200
Corporation Profits Tax					
Motor Vehicles Duties	17,123	1,695	3,896	2,951	28,668
Crown Lands	250	210	330	370	1,160
Interest on Sundry Loans ...	1,196	1,098	2,171	106	4,871
Miscellaneous and Special Receipts	9,036	11,913	1,736	2,625	28,310
Totals	371,156	110,781	163,556	157,197	839,293

YEARS, ended March 31,	1932-33.	1931-32.	1932-33 (compared with 1931-32).		Corresponding years.	
			Increase.	Decrease.	1930-31.	1929-30.
	£	£	£	£	£	£
Customs	167,335	136,152	31,083	—	121,101	119,888
Excise	120,900	119,900	1,000	—	121,000	127,500
Stamps and Estate Duties ...	96,360	82,070	14,290	—	103,260	105,140
Land Tax and Mineral Rights Duty	770	850	—	80	830	880
Postal Service	70,200	69,500	700	—	69,100	68,100
Telegraph Service						
Telephone Service						
Property and Income Tax, including Super-Tax	155,165	408,172	17,073	80	118,591	121,808
	312,189	361,067	—	51,878	323,877	293,816
	767,651	772,539	17,073	51,958	712,168	715,621
Excess Profits Duties, etc. ...	2,300	2,500	—	300	3,000	2,250
Corporation Profits Tax						
Motor Vehicle Duties	27,910	27,180	130	—	27,792	26,802
Crown Lands	1,220	1,250	—	30	1,280	1,290
Interest on Sundry Loans	5,125	13,810	—	8,685	32,890	32,639
Miscellaneous— Ordinary receipts	22,922	29,913	—	6,991	31,330	26,365
Special receipts						
Appropriation from Rating Relief Suspense Account ...	—	3,990	—	3,990	16,300	—
Totals	827,031	851,482	47,503	71,954	857,760	814,970
			NET DEC. £24,151			

Values (c.i.f.) of Imports* into the United Kingdom for the years 1931-32-33.

(From the Monthly Trade Returns, December, 1933.)

	Year ended December 31,			Increase (+) or Decrease (—) in 1933 as compared with 1932.	Increase (+) or Decrease (—) in 1933 as compared with 1931.
	1931.	1932.	1933.		
	£	£	£	£	£
I. FOOD, DRINK AND TOBACCO—					
A. Grain and flour	55,518,037	58,078,379	55,018,379	— 3,060,000	— 799,658
B. Feeding-stuffs for animals ...	5,379,031	6,512,259	5,949,089	— 592,570	+ 570,058
C. Meat	93,905,218	81,068,405	77,610,471	— 3,471,934	— 16,288,777
D. Animals, living, for food ...	16,011,663	10,667,225	7,006,372	— 3,650,853	— 9,008,201
E and F. Other food and drink ...	231,227,621	206,132,098	183,207,853	— 28,221,245	— 51,019,771
G. Tobacco	11,376,456	10,112,846	11,500,069	+ 1,657,823	+ 424,213
Total, Class I	416,721,659	372,941,212	340,599,433	— 32,341,779	— 76,192,226
II. RAW MATERIALS AND ARTICLES MAINLY UNMANUFACTURED—					
A. Coal	31,351	26,609	17,721	— 8,888	— 16,660
B. Other non-metallic mining and quarry products and the like	3,919,570	3,415,035	3,436,817	— 8,218	— 482,753
C. Iron ore and scrap	2,336,590	1,885,080	2,594,117	+ 708,437	+ 257,527
D. Non-ferrous metalliferous ores and scrap	7,229,515	6,188,616	6,747,735	+ 559,119	— 481,780
E. Wood and timber	29,140,529	25,008,052	29,871,705	+ 4,362,053	+ 731,176
F. Raw cotton and cotton waste	27,182,530	31,241,116	36,782,717	+ 5,541,599	+ 9,600,185
G. Wool, raw and waste, and woollen rags	31,544,409	32,300,267	37,453,797	+ 3,953,530	+ 2,909,388
H. Silk, raw, knubs and noils ...	1,238,714	1,372,955	1,340,074	— 32,881	+ 101,360
I. Other textile materials	7,035,974	6,750,132	7,248,561	+ 498,429	+ 202,587
J. Oil seeds, nuts, oils, fats, resins and gums	21,964,275	22,870,515	21,091,824	— 1,478,721	— 3,872,451
K. Hides and skins, undressed ...	11,696,212	12,097,124	14,326,426	+ 2,229,302	+ 2,630,214
L. Paper-making materials	9,976,964	9,816,108	9,342,115	— 473,993	— 634,849
M. Rubber	4,496,458	2,450,217	3,016,591	+ 566,374	+ 1,479,867
N. Miscellaneous raw materials and articles mainly un- manufactured	9,212,089	7,651,371	7,091,971	— 566,400	— 2,157,118
Total, Class II	173,038,210	161,695,427	180,355,169	+ 15,719,742	+ 7,316,959
III. ARTICLES WHOLLY OR MAINLY MANUFACTURED—					
A. Coke and manufactured fuel	18,181	23,766	30,581	+ 6,815	+ 12,400
B. Pottery, glass, abrasives, &c.	9,603,200	5,139,451	5,777,888	+ 638,437	— 3,825,312
C. Iron and steel and manu- factures thereof	19,621,620	8,662,173	6,124,906	— 2,537,565	— 13,496,712
D. Non-ferrous metals and manufactures thereof ...	21,408,132	11,728,938	15,660,185	+ 3,931,517	— 5,717,617
E. Cutlery, hardware, imple- ments and instruments ...	7,275,917	4,509,073	5,139,717	+ 630,644	— 2,136,200
F. Electrical goods and apparatus	6,239,770	2,744,545	2,437,686	— 306,859	— 3,802,084
G. Machinery	15,339,081	10,411,360	8,537,825	— 1,906,535	— 6,801,206
H. Manufactures of wood and timber	7,533,112	5,411,481	5,131,419	— 313,065	— 2,401,723
I. Cotton yarns and manu- factures	8,912,212	1,897,100	2,119,352	+ 222,252	— 6,822,890
J. Woollen and worsted yarns and manufactures	13,416,767	2,337,707	2,325,522	— 32,185	— 11,121,245
K. Silk Yarns and manufactures	8,392,892	3,795,063	3,124,670	— 670,393	— 5,268,222
L. Manufactures of other textile materials	11,042,794	8,742,771	7,443,294	— 1,299,477	— 7,199,500
M. Apparel	19,838,807	7,029,168	7,451,648	+ 422,480	— 12,387,159
N. Chemicals, drugs, dyes and colours	13,311,670	9,600,602	9,815,405	+ 214,803	— 4,026,265
O. Oils, fats and resins, manu- factured	20,413,121	30,893,954	30,165,714	— 733,240	+ 750,593

* The value of the Imports represents the cost, insurance and freight; or, when goods are consigned for sale, the latest sale value of such goods.

Values (c.i.f.) of Imports for the years 1931-32-33—Contd.

(From the Monthly Trade Returns, December, 1933.)

	Year ended December 31,			Increase (+) or Decrease (—) in 1933 as compared with 1932.	Increase (+) or Decrease (—) in 1933 as compared with 1931.
	1931.	1932.	1933.		
III. ARTICLES WHOLLY OR MAINLY MANUFACTURED— <i>Contd.</i>	£	£	£	£	£
P. Leather and manufactures thereof	13,239,940	7,778,033	8,197,310	+ 119,277	— 5,042,630
Q. Paper and cardboard	16,431,232	13,076,174	12,081,539	— 993,635	— 1,349,693
R. Vehicles (including locomotives, ships and aircraft)	4,240,095	3,123,272	2,545,672	— 577,600	— 1,694,423
S. Rubber manufactures	3,420,850	1,788,350	1,783,256	— 2,103	— 1,616,594
T. Miscellaneous articles, wholly or mainly manufactured	28,518,032	16,000,791	15,176,801	— 823,900	— 13,341,141
Total, Class III	261,718,135	137,781,084	151,070,782	— 6,710,302	—110,647,653
IV. ANIMALS, NOT FOR FOOD	3,329,000	2,190,097	760,340	— 1,133,757	— 2,572,600
V. PARCEL POST	6,445,334	4,152,241	3,065,611	— 1,086,600	— 3,379,693
Total	861,252,638	701,670,061	675,847,305	— 25,822,696	—185,105,273

Values (f.o.b.) of Exports of Produce and Manufactures of the United Kingdom for the years 1931-32-33.*

(From the Monthly Trade Returns, December, 1933.)

	Year ended December 31,			Increase (+) or Decrease (—) in 1933 as compared with 1932.	Increase (+) or Decrease (—) in 1933 as compared with 1931.
	1931.	1932.	1933.		
I. FOOD, DRINK AND TOBACCO—	£	£	£	£	£
A. Grain and flour	3,316,315	3,315,215	1,970,958	— 1,344,257	— 1,345,357
B. Feeding-stuffs for animals ...	2,087,171	1,677,943	806,139	— 771,804	— 1,281,035
C. Meat	1,230,611	1,050,028	823,393	— 226,635	— 407,118
D. Animals, living, for food	171,989	83,701	20,756	— 72,048	— 151,233
E. and F. Other food and drink ..	23,498,986	22,072,233	20,780,480	— 1,291,753	— 2,719,506
G. Tobacco	5,216,377	1,199,877	4,091,528	— 106,349	— 1,124,849
Total, Class I	35,522,352	32,318,000	28,490,251	— 3,821,746	— 7,026,098
II. RAW MATERIALS AND ARTICLES MAINLY UNMANUFACTURED—					
A. Coal	31,653,771	31,633,351	31,426,236	— 207,118	— 3,227,538
B. Other non-metallic mining and quarry products and the like	1,082,616	870,200	1,018,526	+ 148,326	— 64,090
C. Iron ore and scrap	420,904	260,103	485,912	+ 225,839	+ 65,038
D. Non-ferrous metalliferous ores and scrap	457,813	729,212	1,005,463	+ 276,221	+ 517,620
E. Wood and timber	230,024	117,056	91,388	— 25,658	— 138,626
F. Raw cotton and cotton waste ..	331,547	495,430	463,734	— 31,690	+ 132,187
G. Wool, raw and waste, and woollen rags	3,270,990	3,451,701	5,315,498	+ 1,860,797	+ 2,044,502
H. Silk, raw, knots and nolls ...	11,963	9,885	9,815	— 70	— 2,148
I. Other textile materials	201,835	356,365	386,484	+ 30,119	+ 185,149
J. Oil seeds, nuts, oils, fats, resins and gums	2,438,216	1,851,621	1,680,515	— 171,106	— 757,701
K. Hides and skins, undressed ..	712,176	511,325	676,547	+ 165,222	— 65,629
L. Paper-making materials	684,006	751,865	908,789	+ 156,934	+ 221,783
M. Rubber	104,920	113,164	95,119	— 18,345	— 9,801
N. Miscellaneous raw materials and articles mainly un- manufactured	2,409,076	2,450,481	2,425,257	— 25,224	+ 16,181
Total, Class II	47,039,396	43,608,082	45,980,823	+ 2,381,241	— 1,050,073

* The value of the Exports represents the cost and the charges of delivering the goods on board the ship, and is known as the "free on board" value.

Values (f.o.b.) of Exports for the years 1931-32-33—Contd.

(From the Monthly Trade Returns, December, 1933.)

	Year ended December 31,			Increase (+) or Decrease (—) in 1933 as compared with 1932.	Increase (+) or Decrease (—) in 1933 as compared with 1931.
	1931.	1932.	1933.		
III. ARTICLES WHOLLY OR MAINLY MANUFACTURED—	£	£	£	£	£
A. Coke and manufactured fuel	2,960,349	2,688,129	2,659,782	+	21,653
B. Pottery, glass, abrasives, &c.....	8,407,468	7,417,019	7,022,855	—	391,164
C. Iron and steel and manufactures thereof	30,375,155	28,010,810	29,917,399	+	1,876,589
D. Non-ferrous metals and manufactures thereof	6,041,361	6,800,326	12,111,920	+	5,251,603
E. Cutlery, hardware, implements and instruments	5,333,526	5,516,995	6,393,117	+	816,122
F. Electrical goods and apparatus	7,437,911	5,745,305	6,699,092	+	912,787
G. Machinery	33,011,639	29,315,957	27,026,788	—	2,189,169
H. Manufactures of wool and timber	1,426,965	1,191,521	993,251	—	198,267
I. Cotton yarns and manufactures	56,598,131	62,816,621	58,933,051	—	3,913,573
J. Woollen and worsted yarns and manufactures	25,150,313	21,003,792	25,582,101	+	1,578,312
K. Silk Yarns and manufactures	1,037,560	1,023,552	858,285	—	165,267
L. Manufactures of other textile materials	12,881,985	13,119,501	11,027,511	—	878,010
M. Apparel	11,011,095	11,829,461	10,736,108	—	1,093,356
N. Chemicals, drugs, dyes and colours	17,017,839	17,376,663	17,517,611	+	140,948
O. Oils, fats and resins, manufactured	5,305,751	5,157,987	4,953,628	—	204,350
P. Leather and manufactures thereof	3,313,955	2,963,138	3,753,850	+	790,412
Q. Paper and cardboard	6,321,269	6,506,159	6,130,955	—	375,504
R. Vehicles (including locomotives, ships and aircraft)	29,713,371	20,784,005	21,856,335	+	872,270
S. Rubber manufactures	2,137,182	1,912,882	2,061,731	+	118,849
T. Miscellaneous articles wholly or mainly manufactured	22,436,715	20,915,619	21,372,986	+	427,367
Total, Class III	292,028,579	275,556,108	280,441,371	+	1,885,263
IV. ANIMALS, NOT FOR FOOD	1,091,271	690,867	494,065	—	120,522
V. PARCEL POST	11,930,097	12,921,231	12,002,896	—	918,335
Total	390,021,598	365,021,008	367,423,909	+	2,390,901

Values (f.o.b.*) of Exports of Imported Merchandise for the years 1931-32-33.

(From the Monthly Trade Returns, December, 1932.)

	Year ended December 31,			Increase (+) or Decrease (—) in 1933 as compared with 1932.	Increase (+) or Decrease (—) in 1933 as compared with 1931.
	1931.	1932.	1933.		
FOOD, DRINK AND TOBACCO—	£	£	£	£	£
A. Grain and flour	1,021,052	1,206,200	757,420	—	448,870
B. Feeding-stuffs for animals	165,837	110,904	58,130	—	52,774
C. Meat	2,628,945	1,484,062	791,221	—	693,441
D. Animals, living, for food	1,071	497	—	—	497
E and F. Other food and drink	15,718,765	11,711,519	9,788,789	—	1,922,730
G. Tobacco	607,275	641,900	691,483	+	49,683
Total, Class I	20,142,945	15,156,772	12,087,043	—	3,068,729

* The value of the Exports represents the cost and the charges of delivering the goods on board the ship, and is known as the "free on board" value.

*Values (f.o.b.) of Exports of Imported Merchandise for the years
1931-32-33—Contd.*

(From the Monthly Trade Returns, December, 1933.)

	Year ended December 31,			Increase (+) or Decrease (—) in 1933 as compared with 1932.	Increase (+) or Decrease (—) in 1933 as compared with 1931.
	1931.	1932.	1933.		
	£	£	£	£	£
II. RAW MATERIALS AND ARTICLES MAINLY UNMANUFACTURED—					
A. Coal	—	—	—	—	—
B. Other non-metallic mining and quarry products and the like	911,682	135,812	198,189	+	62,347
C. Iron ore and scrap	1,750	97	226	+	129
D. Non-ferrous metalliferous ores and scrap	187,569	73,818	116,325	+	42,507
E. Wood and timber	288,586	178,812	191,808	+	12,996
F. Raw cotton and cotton waste	1,190,970	1,587,128	1,739,688	+	152,560
G. Wool, raw and waste, and woollen rags	11,070,560	11,999,912	13,557,118	+	1,557,506
H. Silk, raw, knubs and noils ..	8,398	17,322	11,682	—	5,010
I. Other textile materials	455,501	179,228	250,378	+	71,150
J. Oil seeds, nuts, oils, fats, resins and gums	895,979	491,799	380,535	—	111,261
K. Hides and skins, undressed ..	8,437,920	6,812,088	7,226,102	+	411,311
L. Paper-making materials	61,784	64,716	71,310	+	9,621
M. Rubber	1,816,358	1,121,151	918,927	—	502,221
N. Miscellaneous raw materials and articles mainly un- manufactured	1,060,309	759,827	983,550	+	223,723
Total, Class II	25,710,369	23,721,740	25,619,168	+	1,927,728
III. ARTICLES WHOLLY OR MAINLY MANUFACTURED—					
A. Coke and manufactured fuel ...	416	352	358	+	6
B. Pottery, glass, abrasives, &c.	115,692	59,813	56,920	—	2,893
C. Iron and steel and manu- factures thereof	159,709	72,797	50,670	—	22,127
D. Non-ferrous metals and manufactures thereof	1,510,034	1,313,991	729,255	—	584,739
E. Outlery, hardware, imple- ments and instruments	1,015,187	683,107	702,557	+	19,450
F. Electrical goods and apparatus	215,376	111,036	125,959	—	18,017
G. Machinery	1,203,945	911,711	771,858	—	139,853
H. Manufactures of wood and timber	470,929	221,332	140,151	—	79,898
I. Cotton yarns and manu- factures	344,790	223,116	152,932	—	70,211
J. Woollen and worsted yarns and manufactures	1,025,919	735,158	696,285	—	38,873
K. Silk Yarns and manufactures	584,108	385,970	301,713	—	84,257
L. Manufactures of other textile materials	1,522,195	915,917	880,517	—	35,400
M. Apparel	1,186,300	422,232	163,108	+	40,876
N. Chemicals, drugs, dyes, and colours	1,133,983	554,116	1,171,780	+	617,361
O. Oils, fats and resins, manu- factured	1,838,920	1,776,901	1,111,209	—	335,695
P. Leather and manufactures thereof	1,506,295	1,012,786	1,116,251	+	103,465
Q. Paper and cardboard	192,511	101,837	59,400	—	15,337
R. Vehicles (including loco- motives, ships and aircraft) ..	449,791	313,170	295,893	—	17,277
S. Rubber manufactures	100,606	81,557	131,358	+	46,771
T. Miscellaneous articles wholly or mainly manufactured	2,833,776	1,888,021	1,817,186	—	70,535
Total, Class III	17,410,668	11,826,306	11,109,093	—	717,213
IV. ANIMALS, NOT FOR FOOD.....	693,567	317,438	231,919	—	85,489
Total	63,867,549	51,021,256	49,077,553	—	1,913,703

BANK OF ENGLAND.

Pursuant to the Act 7th and 8th Victoria, cap. 32 (1844),

(000's omitted.)

1	2	3	4	5	6	7	8
ISSUE DEPARTMENT.						COLLATERAL COLUMNS.	
Liabilities.	DATES.	Assets.				Notes in Hands of Public (col. 1 less Notes in Reserve, col. 17).	Minimum Discount Rate.
Notes Issued.	(Wednesdays.)	Govt. Debt (£11,015) and Govt. Securities.	Other Securities.	Gold Coin and Bullion.	Silver Coin.		
£		£	£	£	£	£	Per cent.
394,792	Jan. 4.....	266,231	5,056	119,793	3,713	362,599	2
394,793	" 11.....	266,251	5,034	119,793	3,715	358,683	
394,794	" 18.....	266,243	5,041	119,794	3,710	354,664	
398,610	" 25.....	266,316	4,909	128,610	3,716	353,283	
401,403	Feb. 1.....	266,311	4,973	126,403	3,716	357,310	
402,207	" 8.....	266,354	4,933	127,207	3,713	357,380	
407,263	" 15.....	263,452	7,830	132,263	3,718	355,074	
417,246	" 22.....	266,360	14,928	142,246	3,712	356,249	
425,228	Mar. 1.....	263,949	17,334	150,228	3,717	359,284	
434,954	" 8.....	259,124	12,158	159,954	3,718	363,327	
441,402	" 15.....	259,470	11,866	166,402	3,644	363,816	
444,632	" 22.....	260,783	10,578	169,632	3,689	364,331	
446,339	" 29.....	260,889	10,476	171,839	3,685	367,112	
436,533	Apr. 5.....	247,333	9,024	176,533	3,643	371,669	
438,511	" 12.....	247,594	8,748	178,511	3,658	376,370	
443,964	" 19.....	247,735	8,617	183,964	3,648	376,123	
445,939	" 26.....	247,819	8,539	185,939	3,642	371,935	
445,988	May 3.....	248,329	8,020	185,988	3,651	373,506	
445,989	" 10.....	250,749	5,582	185,989	3,669	372,510	
445,989	" 17.....	251,819	4,533	185,989	3,646	370,637	
445,989	" 24.....	251,848	4,518	185,989	3,634	369,874	
446,332	" 31.....	251,792	4,570	186,332	3,638	374,063	
446,640	June 7.....	254,601	1,752	186,640	3,647	378,463	
447,121	" 14.....	254,601	1,756	187,121	3,643	375,021	
448,096	" 21.....	254,690	1,761	188,096	3,680	372,022	
449,360	" 28.....	254,694	1,467	189,360	3,639	375,125	
449,695	July 5.....	251,901	1,462	189,695	3,637	378,772	
449,695	" 12.....	254,834	1,521	189,695	3,642	378,471	
449,696	" 19.....	254,856	1,500	189,696	3,644	377,374	
450,054	" 26.....	251,552	1,500	190,054	3,648	377,420	
450,155	Aug. 2.....	251,860	1,500	190,155	3,640	382,184	
450,162	" 9.....	254,753	1,607	190,162	3,640	384,974	
450,162	" 16.....	254,820	1,539	190,162	3,611	379,442	
450,169	" 23.....	254,696	1,656	190,169	3,648	374,556	
450,283	" 30.....	254,535	1,823	190,283	3,640	374,003	
450,265	Sept. 6.....	251,061	2,279	190,285	3,640	375,226	
450,376	" 13.....	253,940	2,410	190,376	3,641	374,533	
450,376	" 20.....	251,591	1,764	190,376	3,645	370,470	
450,376	" 27.....	253,920	2,438	190,376	3,642	370,753	
450,376	Oct. 4.....	253,920	2,438	190,376	3,642	373,712	
450,377	" 11.....	251,025	2,336	190,377	3,639	372,444	
450,377	" 18.....	254,131	2,226	190,377	3,643	370,596	
450,447	" 25.....	253,494	2,370	190,447	3,636	369,258	
450,447	Nov. 1.....	253,555	2,806	190,447	3,639	372,197	
450,538	" 8.....	253,895	2,462	190,538	3,643	373,335	
450,538	" 15.....	254,084	2,274	190,538	3,642	369,106	
450,538	" 22.....	254,562	1,788	190,538	3,610	367,528	
450,638	" 29.....	253,267	3,092	190,638	3,611	370,202	
450,638	Dec. 6.....	253,392	2,966	190,638	3,642	374,881	
450,638	" 13.....	253,872	2,481	190,638	3,647	381,891	
450,724	" 20.....	264,172	2,285	190,724	3,543	389,864	
450,720	" 27.....	264,208	2,250	190,720	3,542	391,982	

WEEKLY RETURN.

for Wednesday in each Week, during the Year 1933.

(000's omitted.)

9	10	11	12	13	14	15	16	17	18
BANKING DEPARTMENT.									
Liabilities.				DATES. (Wednes- days.)	Assets.				Totals of Liabilities and Assets.
Capital (£14,533) and Res.	Public Deposits.	Banker's Deposits.	Other Deposits.		Govt. Securi- ties.	Dis- counts and Ad- vances.	Other Securi- ties.	Reserve (Notes and Coin).	
£	£	£	£		£	£	£	£	£
18,098	12,516	134,120	31,235	Jan. 4	102,082	45,990	17,862	32,968	198,902
18,070	12,788	112,921	33,744	" 11	109,968	12,908	17,792	36,861	177,524
18,080	12,116	103,381	32,501	" 18	96,653	11,819	18,804	40,907	168,083
18,080	11,653	103,373	32,476	" 25	90,603	11,662	17,296	46,152	165,613
18,136	42,245	67,762	35,179	Feb. 1	89,378	11,943	17,191	41,812	163,324
18,163	13,502	100,699	32,767	" 8	90,308	12,147	17,125	45,551	165,134
18,174	15,850	106,227	32,766	" 15	90,858	11,970	17,117	52,874	173,119
18,194	26,184	98,300	35,009	" 22	86,380	11,948	17,627	61,734	177,689
18,231	26,441	104,171	31,542	Mar. 1	86,500	11,965	18,543	66,683	183,691
18,230	14,984	112,578	34,325	" 8	78,705	11,761	17,483	72,374	180,323
18,240	21,267	106,146	33,856	" 15	71,910	11,779	17,532	78,319	179,540
18,238	29,026	84,945	34,218	" 22	55,718	11,787	17,879	81,014	166,428
18,244	21,244	92,898	34,966	" 29	57,738	11,770	17,211	80,577	167,296
17,655	14,083	109,599	31,195	Apr. 5	82,980	11,649	15,517	65,601	175,837
17,652	17,972	88,663	35,095	" 12	68,860	11,632	15,929	62,966	159,387
17,670	9,912	103,976	36,014	" 19	75,201	11,830	11,832	68,712	167,575
17,712	10,782	100,936	37,105	" 26	68,531	11,631	11,452	71,924	166,533
17,734	8,811	99,655	37,756	May 3	67,656	11,634	11,278	73,421	163,989
17,767	11,374	87,197	43,173	" 10	62,216	11,613	11,286	74,399	159,514
17,772	15,594	97,298	37,373	" 17	68,151	11,574	11,675	76,340	168,040
17,779	15,707	99,205	37,262	" 24	70,001	11,574	11,237	77,135	169,947
17,785	33,247	77,473	39,536	" 31	72,506	11,260	10,949	78,330	168,044
17,825	8,925	102,410	38,233	June 7	76,289	11,078	10,758	69,275	167,395
17,867	11,611	104,803	38,675	" 14	75,409	12,961	11,362	73,225	172,957
17,916	24,848	95,196	39,800	" 21	73,648	12,677	14,181	77,255	177,761
17,998	14,062	105,121	42,161	" 28	75,373	16,643	11,867	75,459	179,342
18,046	16,175	92,344	49,871	July 5	75,726	16,353	12,176	73,182	176,433
18,064	16,840	96,959	56,381	" 12	87,066	15,100	12,545	73,498	187,199
18,088	19,052	94,159	57,205	" 19	89,591	11,246	14,003	73,606	188,506
18,111	14,137	98,611	57,659	" 26	90,596	11,243	12,240	74,160	188,419
18,130	21,517	89,457	53,810	Aug. 2	90,031	11,172	12,385	69,337	182,915
18,156	19,412	92,791	47,898	" 9	88,296	11,036	12,375	66,555	178,262
18,179	17,257	98,168	42,269	" 16	82,350	10,100	11,442	72,076	175,474
18,200	32,243	90,343	42,402	" 23	84,906	10,000	11,481	76,942	183,389
18,213	47,960	79,426	42,980	" 30	83,196	9,973	11,698	77,603	182,530
18,231	21,454	97,423	41,978	Sept. 6	83,536	9,605	12,423	76,433	182,027
18,233	13,263	106,613	43,942	" 13	88,746	9,185	11,939	79,312	184,082
18,231	18,219	105,688	43,421	" 20	80,656	1,192	14,149	81,203	185,566
18,236	16,488	97,834	43,957	" 27	73,826	9,190	11,986	81,013	179,016
17,652	9,520	108,627	46,308	Oct. 4	81,127	11,056	11,861	78,064	182,108
17,665	10,686	111,327	44,222	" 11	81,103	10,936	12,158	79,344	183,901
17,673	14,459	108,959	45,689	" 18	81,468	8,500	15,556	81,136	186,661
17,689	15,905	104,146	45,775	" 25	77,986	8,501	14,501	82,528	183,516
17,708	7,541	110,644	43,707	Nov. 1	77,021	8,648	14,371	79,560	179,600
17,729	25,244	91,286	40,075	" 8	72,788	8,406	14,611	78,478	174,343
17,754	18,228	108,989	37,077	" 15	71,163	8,557	15,152	82,676	177,548
17,789	18,766	102,991	36,579	" 22	67,816	8,548	15,522	80,240	176,126
17,842	13,637	106,911	36,491	" 29	70,941	8,570	13,756	81,617	174,884
17,881	6,897	115,873	38,414	Dec. 6	78,017	8,496	13,658	76,894	177,065
17,896	14,544	96,862	36,703	" 13	72,907	8,401	13,643	89,814	164,765
17,922	20,036	91,803	36,677	" 20	81,057	8,370	15,251	81,880	166,538
17,975	22,156	101,216	36,545	" 27	88,037	16,756	13,395	89,704	177,892

FOREIGN EXCHANGES.—*Quotations as under, LONDON on Paris, Berlin and Calcutta; New York and Hong Kong on LONDON, 1933.*

DATE. (Wednesdays.)	1	2	3	4	5	6		7
	London on Paris.	London on Berlin.	London on Calcutta.	New York on London.	Hong Kong on London.	Price per Ounce.		
	Cables (middle rate).	Cables (middle rate).	Demand (middle rate).	Cables (closing rate).	T.T.	Gold Bars (fine).	Silver Standard Bars (cash).	
1933.	<i>f. c.</i>	<i>Reichs- marks.</i>	<i>s. d.</i>	<i>\$ c.</i>	<i>s. d.</i>	<i>s. d.</i>	<i>s. d.</i>	
Jan. 4.....	85-43 $\frac{1}{2}$	14-02 $\frac{1}{2}$	1-6 $\frac{1}{16}$	3-34 $\frac{1}{2}$	1-31 $\frac{3}{4}$	123-4	1-4 $\frac{9}{16}$	
„ 18.....	85-77 $\frac{1}{2}$	14-08	1-6 $\frac{5}{16}$	3-34 $\frac{1}{2}$	1-31 $\frac{3}{4}$	123-0	1-4 $\frac{7}{8}$	
Feb. 1.....	87-01 $\frac{1}{2}$	14-29	1-6 $\frac{5}{16}$	3-38 $\frac{7}{8}$	1-3 $\frac{1}{2}$	121-2 $\frac{1}{2}$	1-5	
„ 15.....	87-67	14-43	1-6 $\frac{5}{16}$	3-43 $\frac{1}{2}$	1-3 $\frac{7}{8}$	119-9 $\frac{1}{2}$	1-4 $\frac{1}{2}$	
Mar. 1.....	86-36	14-35 $\frac{1}{2}$	1-6 $\frac{9}{16}$	3-41 $\frac{1}{8}$	1-3 $\frac{1}{2}$	121-11 $\frac{1}{2}$	1-5 $\frac{1}{16}$	
„ 15.....	87-64	14-47 $\frac{1}{2}$	1-6 $\frac{1}{16}$	3-45 $\frac{9}{16}$	1-4 $\frac{1}{16}$	120-3	1-5 $\frac{1}{16}$	
„ 29.....	86-89 $\frac{1}{16}$	14-32	1-6 $\frac{1}{16}$	3-41 $\frac{1}{8}$	1-4 $\frac{1}{16}$	120-11 $\frac{1}{2}$	1-5 $\frac{1}{16}$	
Apr. 12.....	86-36 $\frac{1}{2}$	14-36 $\frac{1}{2}$	1-6 $\frac{1}{16}$	{ ^(11th) 3-41 $\frac{7}{8}$ }	1-3 $\frac{7}{8}$	121-4	1-5 $\frac{1}{8}$	
„ 26.....	87-53	15-05	1-6 $\frac{1}{16}$	3-79 $\frac{1}{2}$	1-4 $\frac{1}{16}$	121-0	1-6 $\frac{1}{2}$	
May 10.....	85-72	14-38	1-6 $\frac{1}{16}$	3-94 $\frac{3}{4}$	1-4 $\frac{3}{8}$	123-4	1-6 $\frac{1}{8}$	
„ 24.....	86-09	14-46 $\frac{1}{2}$	1-6 $\frac{1}{16}$	3-92 $\frac{3}{4}$	1-4 $\frac{9}{16}$	122-8	1-6 $\frac{1}{8}$	
June 7.....	86-03	14-56	1-6 $\frac{1}{16}$	4-07 $\frac{5}{8}$	1-4 $\frac{1}{16}$	122-0	1-7 $\frac{1}{16}$	
„ 21.....	86-34 $\frac{1}{2}$	14-29 $\frac{1}{2}$	1-6 $\frac{1}{16}$	4-17 $\frac{1}{4}$	1-5 $\frac{1}{16}$	122-2	1-7 $\frac{1}{16}$	
July 5.....	85-15 $\frac{1}{2}$	14-09	1-6 $\frac{1}{16}$	4-94 $\frac{1}{2}$	1-4 $\frac{1}{16}$	123-7	1-6 $\frac{1}{16}$	
„ 19.....	84-78 $\frac{1}{2}$	13-94	1-6 $\frac{1}{16}$	4-81	1-5 $\frac{1}{16}$	124-4	1-6 $\frac{1}{8}$	
Aug. 2.....	84-78	13-92	1-6 $\frac{1}{16}$	4-53 $\frac{1}{2}$	1-4 $\frac{1}{8}$	124-3	1-5 $\frac{3}{8}$	
„ 16.....	84-22	13-84 $\frac{1}{2}$	1-6 $\frac{1}{16}$	4-40	1-4 $\frac{1}{16}$	125-3	1-5 $\frac{3}{8}$	
„ 30.....	81-3 $\frac{1}{2}$	13-44 $\frac{1}{2}$	1-6 $\frac{1}{16}$	4-53	1-4 $\frac{1}{8}$	123-9 $\frac{1}{2}$	1-6 $\frac{1}{8}$	
Sept. 13.....	81- $\frac{5}{8}$	13-39 $\frac{1}{2}$	1-6 $\frac{1}{16}$	4-59 $\frac{1}{2}$	1-5	129-9	1-6 $\frac{1}{8}$	
„ 27.....	79- $\frac{9}{16}$	13-05	1-6 $\frac{1}{16}$	4-72 $\frac{1}{2}$	1-5 $\frac{7}{16}$	133-0	1-6 $\frac{1}{16}$	
Oct. 11.....	79- $\frac{9}{16}$	13-02 $\frac{1}{2}$	1-6 $\frac{1}{16}$	4-66	1-5 $\frac{1}{8}$	133-1 $\frac{1}{2}$	1-6 $\frac{1}{16}$	
„ 25.....	81- $\frac{1}{32}$	13-25	1-6 $\frac{1}{16}$	4-76 $\frac{1}{2}$	1-5 $\frac{1}{16}$	130-1	1-6 $\frac{1}{16}$	
Nov. 8.....	80- $\frac{7}{32}$	13-18	1-6 $\frac{1}{16}$	4-97 $\frac{1}{2}$	1-5 $\frac{3}{8}$	131-10	1-6 $\frac{1}{8}$	
„ 22.....	83- $\frac{1}{32}$	13-73	1-5 $\frac{7}{8}$	5-39 $\frac{1}{2}$	1-5 $\frac{1}{8}$	126-6	1-6 $\frac{1}{16}$	
Dec. 6.....	83- $\frac{7}{32}$	13-65	1-6 $\frac{1}{16}$	5-11	1-5 $\frac{3}{16}$	126-11	1-6 $\frac{5}{8}$	
„ 20.....	83- $\frac{3}{32}$	13-74	1-6 $\frac{1}{16}$	5-08 $\frac{1}{2}$	1-5 $\frac{1}{16}$	126-9	1-6 $\frac{1}{16}$	

JOURNAL
OF THE ROYAL STATISTICAL SOCIETY
PART II, 1934.

THE *Economist* INDEX OF BUSINESS ACTIVITY.

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[Read before the Royal Statistical Society, January 16th, 1934, the PRESIDENT,
the RT. HON. LORD MESTON OF AGRA AND DUNOTTAR, K.C.S.I., LL.D., in
the Chair.]

It would perhaps be an exaggeration to say that the general public has ever felt the need of an index of business activity. But every statistician must at one time or another have wished for some way of estimating the amplitude of the fluctuations in the general activity of the community. We know that at times the available labour and capital are most inadequately employed, that portions of these "factors of production" are left idle, and consequently do not, in fact, make the contribution to the income of the community which they are capable of making. We know that at other times the capacities of the community are more fully utilized, with a corresponding increase in material well-being for all sections of the population. We know that at other times we are on our way from one state of affairs to the other. We know these things; much of economics is devoted to the analysis of their origins; the conduct of private and public affairs is increasingly conditioned by them; but up to the present we have been unable to submit them to measurement, to say just how active or inactive the community is at any moment. The *Economist* has for some time past been attempting to fill this gap. For some years a number of statistical series drawn from different divisions of the life of the nation have been published month by month in comparable form. From the start it was the intention that these series should ultimately be combined into a single monthly Index of Business Activity. This has now been done, and the complete figures of the new index and its component series were recently

published.* The index is being carried on, the figures for each month being published in the fourth week of the month following. The purpose of this paper is to outline some of the problems which were encountered in the composition of this index and the methods by which they have been surmounted, and to comment on the results that emerge.

A necessary preliminary to any attempt to construct an index of business activity is to define exactly what is meant by the term. Indices of production are familiar in most countries, and in the absence of any index which throws its net wider, they are frequently used as indications of the whole activity of the community. But they have obvious weaknesses for this purpose. Productive industry is still the foundation of all economic wealth, but the superstructure of distribution and service is yearly growing in size and importance. Two of the subsidiary series of the *Economist* index illustrate this point very clearly. The index of Employment in the Heavy Trades has declined almost uninterruptedly from 1924 to the present day. On the other hand, the index of Employment in the Distributive and Kindred Trades has shown an increasing tendency which the disastrous conditions of 1930 and 1931 could interrupt but not reverse. In the second place, it is a well-known economic phenomenon that the swings of activity in productive industry are considerably greater than the fluctuations of the economic life of the community as a whole. An index of business activity must therefore cast its net far wider than industrial production. It must take account not only of the rate at which goods are produced, but of the rates at which they are distributed, transported and sold. Nor is this enough, for the part which services play is growing both in size and importance; they too must be measured. Our object, in short, must be to indicate the fluctuations in the economic activity—that is, the income-producing activity—of the community as a whole.

This conception clearly has close affinities with that of the National Income. There is, however, one important difference. The National Income is expressed in terms of money—it is a summation of the money incomes of the individual members of the community—and it is consequently liable to be affected by changes in the value of money. The conception of the total economic activity of the community, on the other hand, is a non-monetary one, from which considerations of value should be excluded. Either way of stating the case has drawbacks. National Income figures may have to be

* "An Index of Business Activity." Supplement to the *Economist*, October 21, 1933. Since the publication of this Supplement, many of the later figures have been revised. The revised figures are printed in the Monthly Trade Supplement to the *Economist* of December 30, 1933.

“corrected for price changes”—a statistical catchword which evokes a multitude of difficulties—before they can be used for comparative purposes. On the other hand, it is difficult to envisage clearly what is meant by the aggregate of economic activity in “physical” units. The National Income is the aggregate of the incomes of the members of the community; the economic activity of the community consists of the aggregate of the goods they produce or the services they perform in return for those incomes. In any case, whatever might be theoretically preferable, the compiler of an index of business activity is almost forced to reckon in “physical” units, for his material will consist largely of series which are expressed in such things as tons, numbers of men employed, units of electricity and motor-cars. It is obviously easier, and less hazardous, to remove the price element from those series which contain it than to attempt to put it into such series as are expressed in physical units.

The object of our endeavours is, then, to measure the counterpart of the National Income, the National Real Income, as it were. To accomplish this task at all completely is clearly impossible, and we necessarily have to confine ourselves to combining as many indications as are available in the hope that the “sample” thus obtained will be adequately representative of the whole. For the purposes of an index which is to be published month by month, only those data which are published monthly and within a few weeks of the month to which they refer can be considered. Furthermore, before a statistical series can be used, it is necessary to have figures for a number of years back, in order to calculate the normal seasonal fluctuation and in order to be sure that special factors do not invalidate it as an indication of economic activity in general. How many series of monthly statistics, published promptly, available for several years past, and representative of economic activity in general, are at the disposal of the British statistician? Compared with the rich choice of the United States, he is painfully limited. He cannot pick and choose an *à la carte* meal of balanced qualities and blended tastes; he must put every scrap vouchsafed to him into the pot, give thanks for small mercies, and trust that the ensuing *ragoût* is palatable.

American Indices of Business Activity.

As a preliminary to the discussion of the way in which the *Economist* index has been calculated, a brief mention of the more familiar American indices may be of interest.

The most frequently quoted of these indices is that of the *New York Times*. Its fame is largely due to the fact that it is published every week. A weekly index of business activity is quite outside

the bounds of statistical possibility in this country, as the railway traffic receipts are virtually the only available figures, and even they are presented in such a form as to need considerable correction. Even in America the position is not very much better. The *New York Times* index is composed of six component series: Carloadings (i.e. Railway Freight), Steel Mill Activity, Electric Power Production, Automobile Production, Lumber Production and Cotton Forwardings. Most of these series fluctuate more widely than the general level of business activity. The index of Cotton Forwardings, in fact, varied so widely during 1933 that it had to be excluded for a period. The combined index rose from about 60 per cent. of the estimated normal in March, 1933, to almost 100 per cent. of the normal in July. Without cotton forwardings the rise was from about 60 to about 87. Even this rise, however, is an exaggeration of the change which took place. Marvellous as was the recovery in the United States in the second quarter of 1933, it is hardly possible for the degree of economic activity in any country to increase by nearly 50 per cent. in four months. Nevertheless, the *New York Times* index has a certain utility as a sensitive indication of the trend of events.

The same index in a rather fuller form is published monthly in the *Annalist*, a financial review issued by the New York Times Co. The *Annalist* index includes the six series of the *New York Times* index, some of them in a slightly different form (thus: steel ingot production instead of steel mill activity; cotton consumption instead of cotton forwardings), with the addition of six more series: pig iron production, wool consumption, silk consumption, boot and shoe production, cement production and zinc production. Each of these series is separately corrected for its "normal" long-term trend, the calculation being based in most cases on the period 1921-31, but different periods being used for some series. For this reason it is difficult for the compiler, and impossible for the user, of the index to say what is the estimated "normal" progression of the whole index, which is taken as 100 throughout. As a result the index is of little use in estimating the actual variations of activity, even if it were satisfactory in other ways. Seasonal variation is estimated for each series separately by the method of link relatives. Weighting is effected by the ingenious method of first assigning an "effective weight" to each series and then dividing this "effective weight" by the maximum range of the series in the years 1929-32. This has the effect of giving additional weighting to the more stable series. Electric power production, for example, which has an "effective weight" of 15 per cent., acquires a final weight of 35 per cent. The next highest is freight car loadings, with a final weight of 21 per cent. These two together consequently comprise 56 per cent.

of the whole index, while the weights of the other ten series range from 9 per cent. (cotton consumption) down to 2 per cent. In spite of this premium placed upon stability the index has far too wide a range, falling from 116.7 in July, 1929, to 58.5 in March, 1933, and thence rising to 89.5 in July, 1933—a rise of 53 per cent. in four months! This is undoubtedly due to the fact that productive industry plays too large a part in the composition of the index. It may be noted that the movements in the index of electrical power production were only from 105.9 in July, 1929, to 80.0 in March, 1933, and to 96.9 in July, 1933. Without the heavy weight given to this stable series, the fluctuations would be very wide indeed.

Another well-known index is that published monthly by *Babson's Reports, Inc.*, a business forecasting organization. This index is based upon no less than 57 separate series. Twelve series relate to statistics of agricultural marketing (such things as "wheat receipts at eleven markets" and "apple carload shipments") and six to the processing of food-stuffs (cattle slaughter, flour production, etc.). There are eight series representing the activity of the textile trades, one for rubber, two for the automobile industry, three for coal and oil products, two for iron and steel, four for paper, printing and publishing, one each for cement and boots and shoes, four for tobacco, nine for mining and one each for building and construction, electric power production, railway freight, imports and exports. These series are all weighted in strict proportion to the net production of the industry in question as shown by the figures of the Census of Manufactures. The weight assigned to imports and exports is consequently that which corresponds not to the volume of goods entering and leaving the country, but to the "value added" by the handling of these goods. Seasonal variation is removed by the proportional method, the basis being a moving one of the seven years of which the month in question is the middle. The fact that it is possible to compile an index such as this every month is an eloquent testimony to the excellence of American industrial statistics. The resulting index, however, is no more than an index of industrial and agricultural production, and the addition of series representing electric power production, railway traffic and foreign trade, with a combined weight of only $17\frac{1}{2}$ per cent. of the total, is hardly adequate to alter this fact.

The three indices already discussed all partake more of the character of indices of production than of that of indices of business activity. An attempt to remedy this defect has recently been made in a weekly index published by *The Econostat*, a new weekly paper of which Mr. Joseph Staggs Lawrence is the editor. This index is composed of three subsidiary indices, the index of financial activity

with a weight of 17 per cent., the index of distribution with a weight of 31 per cent. and the index of production with a weight of 52 per cent. These descriptions are, however, partly misleading, as of the three sub-components of the index of distribution, two are financial, to wit, bank debits outside New York, and deposit circulation outside New York. In effect, 37 per cent. of the total index is purely financial, consisting of the volume and velocity of payments by cheque, the level of money rates (a peculiar ingredient) and sales of stocks, bonds and new issues. A further 38 per cent. is pure industrial production, leaving only 26 per cent. for carloadings and electric power production, which are the only series representative of divisions of activity other than production and finance. Hence this index, in spite of appearances to the contrary, is not a satisfactory measure of business activity as a whole. It has one further peculiarity, in that six of the seventeen component series are corrected for the long-term trend, while the others are not. The index is therefore neither a measure of the absolute volume of activity nor of the volume relative to a computed normal, but partly one and partly the other. Moreover, even those series which are not corrected for long-term trend are not all related to the same period. For seven of them, 100 is the average of 1919-31, for three, 100 = the average of 1927-31, and for the one remaining, 100 = the average of 1928-32. Some of these defects are inevitable in the case of a weekly index, but it is doubtful whether accurate calculation to one place of decimals is worth while when the basis is so varied.

These American indices have several features in common. In the first place, they seem to me to be far too heavily weighted with purely industrial production. In the Babson index, for example, industry accounts for 48 per cent. of the total weighting, even after the exclusion of Power Production (*i.e.* coal, oil and electricity). Judging by the Census of Manufactures, however, the net product of industry, in this sense, has never exceeded a third of the National Income. The tendency to over-emphasize manufacturing and similar industries is probably due to the general excellence of American manufacturing statistics; and also in part—I suspect—to the fact that the availability of the Census of Manufactures figures conveniently solves the problem of weighting.

Another feature which is common to most—but not to all—of the American indices is that they are related not to any particular period in the past but to a calculated "normal." It is observed that over a period of years the index appears to be fluctuating about a certain trend line, and it is then assumed that this trend can be extended into the future. This method has certain advantages, once the major hypothesis of continuous progress is made, as it

concentrates attention upon the question whether the previous rate of advance is being maintained or not. On the other hand, it has certain disadvantages. In the first place, the trend which is assumed is necessarily quite arbitrary and may prove to be at variance with the facts. Secondly, the assumption of a normal upward trend depresses the index in periods of falling—or even of insufficiently rising—activity. Thirdly, it makes any determination of the *actual* rate of progress (as distinct from the assumed normal) a complicated calculation, even when the assumed normal rate is clearly stated, which is not usually the case. It is not for me to pronounce judgment between these different methods; it will later be clear that one of them was forced upon us by the circumstances of the case. Perhaps the most satisfactory compromise is that of the Babson index, which is calculated on a fixed base (the average of the period 1923–27), but which is graphically represented in such a way that the deviation from the trend is the first thing to strike the eye.

In commenting upon these indices I am for the moment sitting in the judgment chair of the theoretical statistician. One need only attempt to construct one's own index to realize how impossible it is to avoid a large crop of illogicalities. No claim is made that the *Economist* index is in general superior to the American indices; our sources of data have been scantier and we have not been able to employ the almost endless array of statistical devices which are at the disposal of American researchers. To take one example only: the Babson index is seasonally adjusted on a seven-year moving basis of considerable complication, and weighted differently in different periods. Such refinements as these are physically beyond the scope of the busy journalist.

The "Economist" Index: The Component Series.

The basis of the *Economist* index is the series of separate indices which have been published in our Monthly Trade Supplement for some years past. These indices are all based upon the average of 1924, and they all extend back to the beginning of that year. They have been published in the form of three months' moving averages, but the actual monthly figures were, of course, available. Those of the series which originate in monetary values have from the start been corrected for price fluctuations. None of them, however, has previously been adjusted for seasonal variations, as these were not known when the series were started. Here, then, was a rich mine of raw material, which absolved us from the necessity of a very great deal of preliminary work. There were eighteen of these series, and each in turn was scrutinized with a view to its inclusion. Two

of them were rejected as unsuitable. One of these was an index of rubber consumption, the range of which was so large and the fluctuations so sudden, that it would unduly distort any index of which it was a part unless given a very small weighting, in which case the influence of its more significant movements would be negligible. The other was an index of the volume of British trade, which, being based on the quarterly calculation of the Board of Trade, was only available every three months. As there were four other indices relating in whole or in part to foreign trade, it was decided to omit it entirely.

The next question to be faced was whether the remaining sixteen series constituted, in combination, an adequate and reasonably accurate representation of the activity of the nation as a whole. To begin with we had four series based on the monthly employment figures of the Ministry of Labour—one instance in which we are more fortunate than the American compilers. In theory, these should by themselves provide a perfect measure of business activity. In practice they do not entirely do so, as the fluctuations in total employment are always smaller than those in general activity. The index of employment in all trades, for example, fell only from 108, the highest point touched, in 1929, to 97½, the lowest point touched, in 1932. Nevertheless, the employment figures provide an invaluable foundation for any computation of business activity. So far as productive industry is concerned, we had indices covering the iron and steel and cotton industries, as well as series based on imports of raw materials and non-ferrous metals and on exports of manufactures. In addition there were indices of railway traffic, of the consumption of coal and electricity and of movements of shipping. These were the indices of actual physical production and movement to be combined with the employment figures. The remaining series—postal receipts and bank clearings—are more important as indicators of activity elsewhere than as factors of importance in themselves.

Now clearly this is, at best, an imperfect survey of the nation's activities. Only a handful of the major industries is directly represented; agriculture and retail trade are entirely omitted. Unfortunately, the only too obvious gaps cannot be filled in the present deplorable state of British statistics. A search for new series was instituted, but only two of a nature suitable for inclusion could be compiled, and neither of these two—building activity and the registrations of motor vehicles—extends further back than 1928. It is to be hoped that an index of the volume of retail sales may soon emerge from the valuable researches of the Bank of England. This would be a very notable addition to our statistical equipment.

But even in such a case, we shall not be able to include any new series in our Index of Business Activity until we have figures for a sufficient number of years to be able to estimate the seasonal fluctuation.

In spite of all imperfections, however, the eighteen series taken together do provide a cross-section of the life of the community which cannot be very misleading. It is hard to think of any form of economic activity which is not reflected in the employment figures, the consumption of power, railway traffic or foreign trade. The basic indices are therefore sufficiently catholic in composition. Furthermore, they are well balanced in their degree of fluctuation. Of the eighteen series, six have a maximum range of fluctuation of less than 25 points in the last ten years (omitting the exceptional period of 1926) and seven of more than 50 points. We felt justified in concluding that an index composed of these series would at least be better than no index at all.

Before proceeding to the methods of calculation, I will give a brief description of each of the component series. The *Employment* indices speak for themselves. They are the estimates published monthly in the *Ministry of Labour Gazette* arranged as percentages of the average of 1924. Four indices are given; one is the total of employment; the *Heavy Trades* index includes coal-mining, the metal trades and shipbuilding; *General Industry* covers other productive industries; and the *Distributive Trades* includes the clothing trades, transport and public utilities, food, drink and tobacco as well as the distributive trades proper. The *Consumption of Coal* index is calculated by taking the production of the mines, subtracting exports (including foreign bunker coal) and further subtracting the estimated consumption of coal in the manufacture of steel.

The *Consumption of Electricity* index gave us a great deal of trouble. The production of electricity by electric supply companies has very greatly increased in recent years, say by 60 per cent. since 1924. A great deal of this increase is the result of switching over from other sources of power to electricity. The index of the consumption of coal would not decline (except to a very small extent) as the result of such a transfer, since nearly the whole of electricity consumed in this country is steam-generated. Unless, therefore, the increase in electricity production arising out of transfer from coal and gas were eliminated from the index, the final combined Index of Business Activity would show a quite spurious rise. In the second place, the figures of the electricity supply companies have been swollen by the number of electricity users who have abandoned their own generating plants and connected themselves to the "grid."

This source of increase must also clearly be removed. On the other hand, we must take care not to eliminate the genuine increase in getting rid of mere transfers. There are several additional complications which need not be mentioned here. The index as used is based on total generation corrected by an index of the number of "new connections" (i.e. new consumers). It rises from 100 in 1924 to 111 in 1929 and then falls again to 102 in 1931. I am inclined to think that this under-estimates the increase in the total consumption of electricity, but it represents the best statistical compromise that we were able to achieve.

The *Merchandise on Railways* figure is based on the returns which were previously published every month and are now issued every four weeks. These returns give the traffic conveyed in tons, and should be distinguished from the weekly traffic receipts, which are expressed in money. The classification of coal and other minerals is omitted, as its great weight would entirely swamp the other classifications, which are of much greater interest as indicators of general business conditions. Live-stock is also omitted.

Postal receipts is derived from the monthly Post Office return of total receipts for postal business. The figures have not been corrected for price changes, since the changes in postal rates since 1924 have been very small. Should the penny post ever be restored, we shall have to face the problem of devising a price corrector.

Motor Vehicle Registrations is one of the two new series. It is based on the monthly return made by the Ministry of Transport of motor vehicles registered for the first time. This refers directly neither to the activity of the motor industry, for it includes imported cars and excludes exported cars, nor to the activity of motor transport, for it refers only to new cars. Nevertheless, it does provide an indirect measure of both these factors, for an increase or decrease in purchases of motor vehicles will, other things being equal, be accompanied both by an increase or decrease, as the case may be, in the activity of the motor industry and also by a rise or fall in the volume of motor transport. It was consequently decided to include the index. The Ministry of Transport's figures give data for the various classes and sizes of vehicle, but we deemed it impracticable to produce anything in the nature of a weighted index. We have therefore taken the total figures, excluding only motor-cycles. This series is available only since June, 1928. For the preceding years we have annual figures, and have consequently assumed that the fluctuation from year to year was spread regularly over the twelve months from July of one year to June of the next.

The index of *Building Activity* is the other new one. The raw material for this consists of two sets of figures published by the

Board of Trade. The Ministry of Labour collects every month from 146 local authorities (none of which are in London) the total value of building plans approved by them. These figures are published under two heads, "dwelling-houses" and "other buildings." Unfortunately, it rarely occurs that all 146 authorities make their returns sufficiently promptly, and the return, when first published, refers to some smaller number of bodies. As the missing districts are not always the same, direct comparison of these value figures is very difficult. The Board of Trade also publishes two index-numbers based on these figures but making allowance for the missing districts. Hitherto our method has been to take these two index-numbers and calculate a weighted average of them, weighting "dwelling-houses" twice as much as "other buildings." The result obtained by this method, though surprisingly accurate, cannot be completely correct and I am glad to say that through the co-operation of the Ministry of Labour we shall in future be able to use the original figures instead of the index-numbers. In any case, whichever method is used, the resulting index is one of the value of plans approved. There consequently remains the problem of discovering a price corrector. For this purpose we have calculated an index of building costs. This index is a simple affair: we have taken monthly quotations from *The Builder* for eight grades of labour and eight varieties of materials and calculated an unweighted arithmetical average. The procedure is not theoretically impeccable, but in fact the variations are relatively so small that accuracy is not seriously endangered. To weight labour and materials equally accords with the figures of the Census of Production. As for the individual materials, it would be impossible to contrive a system of weighting which would apply to all types of building. The resulting index of building costs falls from 100 in 1924 to 82.9 in November, 1933. The index of the value of plans authorized is now divided by the index of building costs to give an index of building activity in "physical" units. The index of building activity starts at the beginning of 1928, but the gap of the preceding four years has been filled in the way already described in the case of the *Motor Vehicle Registrations* index.

The index of the *Consumption of Iron and Steel* is based upon the output of pig iron *plus* the pig equivalent of imports and *less* the pig equivalent of exports. The index of the *Consumption of Cotton* is based upon the net import figures with an allowance for the variation of stocks in Liverpool. Neither of these two indices is very satisfactory and we are now undertaking a revision of them, utilizing figures of steel ingot production in the former case and figures of forwardings of cotton to the mills in the latter.

The indices of *Imports of Raw Materials* and *Exports of British Manufactures* are based on the trade returns corrected by the quarterly indices of average value issued by the Board of Trade. The index of *Imports of Non-Ferrous Metals* is a weighted average of imports (by volume) of tin, zinc, lead, copper ore, copper bars, and manganese ore. The index of *Movements of Shipping* includes entrances and clearances of foreign-going ships and the general coasting trade of Great Britain. It is based upon the figures published in the “*Monthly Accounts Relating to Trade and Navigation*,” omitting the trade with Northern Ireland and the Irish Free State.

The two remaining indices are those of *Bank Clearings*. One is the total of the Provincial clearings, corrected by the mean of the *Economist* index of wholesale prices and the Ministry of Labour index of the cost of living. The other is the total of the London clearings—Town, Metropolitan and Country together—corrected by the same price index. We had considerable doubts in our minds on the inclusion of these indices, and since the publication of the Index we have received more comment on this point than on any other. Most of these comments have disputed the correctness of using bank clearings as an index of business activity and have in particular criticized the inclusion of the London Town clearing. On the other hand, the comment has been made that bank clearings, when suitably corrected, are by themselves an adequate indication of the whole economic activity of the community. In the Bank of England's Statistical Summary for November there is a chart showing the *Economist* index and two indices of bank clearings, showing the total of the Metropolitan, Country and Provincial clearings with and without correction for price fluctuations. Although the chart is printed without comment the inference is plain.

In deciding to utilize these two series we took the view that the indications provided by movements of the bank clearing totals, although difficult to interpret, were too valuable to disregard. For the great bulk of the economic life of the nation, fluctuations in activity will affect, among published statistics, only the clearings figures and the unemployment returns, and the latter, as has already been pointed out, are not entirely satisfactory. As for the inclusion of the London Town clearing, this can be defended on several grounds. In the first place, a great deal of the vital business of the nation is accomplished in the City of London—insurance transactions, the Stock Exchange turnover, the new issue market and many others—and if the speculative chaff cannot be winnowed from the genuine grain it is at least as excusable to include both as to omit both. In the second place, even those transactions which are purely speculative nevertheless form part of the economic activity of the

nation, and many thousands of people earn their livings by means of them. It would, of course, be preferable to obtain the aggregate net incomes of the stock-jobbers, the rubber brokers, the underwriters, and their fellows, but since that cannot be done, it is surely desirable to have some measure of their activity. Another difficulty in connection with bank clearings is their correction for price fluctuations. Neither a wholesale price index nor the cost of living is relevant to the total of financial transactions, and it is clear that our rough-and-ready compromise of the average of the two gives very unsatisfactory results. Our index of London Bank Clearings, for example, is nearly 7 per cent. higher in 1930 than in 1929—solely owing to the fall in wholesale prices. The Bank of England, in the chart already referred to, used Mr. Keynes' "General Price Level," an index calculated by weighting wholesale prices 2, wages $3\frac{1}{2}$, cost of living $3\frac{1}{2}$, and rent $\frac{1}{2}$. We are far from satisfied with the indices as they stand, and it may be that we shall decide to revise them when opportunity offers.

Construction of the Index.

Having decided upon the component series which were to be included in the index, the second part of our task was to devise some means of combining them. All the existing series were calculated on the base of the average of 1924, and the two new series were related to the same basis in the manner which has been described.

Another necessary preliminary was to correct the series for normal seasonal variations. This at once raised a difficulty. The years over which the figures extend have contained several distinctly abnormal periods. May, 1926, was clearly not a normal May. The development of events since the beginning of 1930 has been such that normal seasonal fluctuations have been overshadowed by the effects of the economic crisis. In the circumstances, the only course open to us was to take as our "normal" period the years 1924 to 1929 inclusive and to omit from those years the twelve months beginning May 1st, 1926. We are thus left with only five years on which to base our calculation of normal seasonal fluctuation. This is far too narrow a basis to give entirely satisfactory results, but we had no choice. In the circumstances there seemed to be little point in utilizing any of the more complicated statistical methods of calculating the seasonal correction, and the simple proportional method was used. Every January figure, for example, was multiplied by a factor arrived at by dividing the average of all months by the average of Januarys. Five indices were not corrected for seasonal fluctuations. In one of these, iron and steel, the non-seasonal fluctuations are so great that any "normal" seasonal fluctuation

that could be calculated would be quite arbitrary and accidental. The other four are the Employment indices. The perceptible seasonal fluctuation in the "All Trades" index is so small as to make no practical difference. In these circumstances it necessarily follows that the very small seasonal fluctuations in the three subsidiary series must offset each other.

Before leaving the subject of seasonal fluctuation it may be of interest to give figures showing the combined normal seasonal fluctuation of all the series included in the index. I have computed a weighted average of the correcting factors, and from them have deduced the normal fluctuation of each month above and below the annual average. This is shown in the following table, which makes allowance for the varying length of the month.

January	... 101	May	... 100	September	... 96
February	... 106	June	... 99	October	... 99
March	... 103	July	... 98	November	... 104
April	... 101	August	... 92	December	... 101

These figures are interesting rather than important, for they will be true of economic activity in general only in so far as the eighteen series of the index are representative *as regards seasonal fluctuation* of activity in general. A series may be a very good indication of the *cyclical* movements of general activity but quite untypical of *seasonal* movements.

After removing, as well as may be, the normal seasonal fluctuation, the only remaining problem is that of weighting. With elements as disparate as bank clearings and employment, imports of raw materials and consumption of electricity, there is no standard of comparison by which weights can be scientifically computed. We were at first tempted to use no weights and to trust to the balanced character of the list of components to produce an accurate result. In fact, the curve of an unweighted arithmetical average is not very different in general appearance from that finally evolved. But on reconsideration it appeared to be wholly indefensible to give, for instance, imports of non-ferrous metals the same weight as the employment totals. On the other hand, any distribution of weights must necessarily be arbitrary and a matter of guess-work. Since scientific calculation was out of the question, it was decided to use the simple system of allotting weights of 4, 3, 2, or 1 to each of the series. In allotting these weights, several considerations were taken into account. The first was, of course, the size of the industry, where any particular industry was referred to. Thus, it was easy to decide that "Employment in the Distributive Trades" should have three times the weight of "Employment in the Heavy Trades." Secondly, some indices which on mere considerations of size would

receive small weights were given heavier weights in view of their excellence as indicators of activity in other lines: Postal Receipts is the outstanding example. Thirdly, some indices were given reduced weightings because they are expanding industries and to that extent untypical (*e.g.* Motor Vehicle Registrations). Fourthly, indices which are subject to sudden distortion by temporary factors were given reduced weights: the distortion of London Bank Clearings by the War Loan Conversion scheme is a case in point. Fifthly, several indices, notably Iron and Steel Consumption and Cotton Consumption, were reduced in weight owing to their inherent tendency to violent fluctuation. Lastly, any index which was less satisfactory than the rest as a measure of what it purported to be was reduced in weight: for example, Motor Vehicle Registrations is only an indirect measure either of motor transport in general or of automobile production.

As a result of taking all these factors into account and guessing as intelligently as we are able, we decided upon the following weighting:—

Employment—All Trades	... 4	Building Activity	... ... 2
Employment—Heavy Trades	... 1	Consumption of Iron and Steel...	2
Employment—General Industry	3	Consumption of Cotton	... 1
Employment—Distributive		Imports of Raw Materials	... 2
Trades, etc.	... ... 3	Imports of Non-Ferrous Metals	1
Consumption of Coal	... 4	Exports of British Manufactures	3
Consumption of Electricity	... 2	Movements of Shipping	... 2
Merchandise on Railways	... 4	Provincial Bank Clearings	... 4
Postal Receipts	... ... 3	London Bank Clearings	... 3
Motor Vehicle Registrations	... 2		—
		Total	... ... 46

The effect of these weights is perhaps more apparent when they are grouped. If we divide the import and export figures equally between Home Industry and Foreign Trade, the result is as follows:—

Employment	... ... 11, or 24 $\frac{0}{10}$ % of the total
Consumption of Power	... ... 6, or 13 $\frac{0}{10}$ % "
Domestic Trade and Transport	... ... 9, or 19 $\frac{1}{10}$ % "
Other Home Industry	... ... 8, or 17 $\frac{1}{10}$ % "
Foreign Trade	... ... 5, or 11 $\frac{0}{10}$ % "
Financial	... ... 7, or 15 $\frac{0}{10}$ % "

I think this distribution is broadly correct. Agriculture, of course, is almost entirely lacking. Perhaps in a few years time the new Marketing Boards will enable us to fill this lacuna. The "Trade and Transport" group is already adequately represented, but it would be desirable to supplement it with an index of the volume of Retail Trade, and we are not without hope of being able to do so before long. The only group which seems to be under-weighted is that of "Other Home Industry." If only Trade Associations were a little more forthcoming with their statistical data it would be possible to repair this defect.

*The "Economist" Index of Business Activity.**

(Average of 1924 = 100.)

	1920 (a).	1921 (a).	1922 (a).	1923 (a).	1924.	1925.	1926.	1927.	1928.	1929.	1930.	1931.	1932.	1933.
January ...	102.1	90.4	82.7	95.3	95.6	103.6	103.2	107.5	106.8	110.4	111.8	99.2	94.4	95.5
February ...	104.3	82.7	83.3	92.9	99.8	102.8	102.8	107.2	107.1	105.0	110.2	96.0	95.7	95.9
March ...	101.0	76.8	84.2	93.1	99.0	102.7	104.3	110.6	107.2	107.4	109.7	98.2	96.3	98.4
April ...	101.2	57.8	85.9	93.7	98.9	102.0	105.2	108.1	106.5	112.0	110.2	97.4	97.7	95.6
May ...	93.9	51.1	88.8	91.9	103.2	101.1	73.0	109.2	104.6	109.7	108.1	96.2	93.3	99.3
June ...	104.5	54.4	87.0	98.3	98.6	101.7	84.9	108.4	107.0	108.9	105.5	98.8	98.5	100.0
July ...	99.3	72.5	88.1	90.7	101.6	101.8	86.2	106.9	104.7	112.0	102.8	99.2	95.1	99.5
August ...	101.2	80.6	95.3	94.5	100.6	99.0	89.8	107.5	106.7	112.2	103.6	95.2	94.2	103.7
September ...	101.6	81.5	89.3	93.3	101.1	100.2	91.9	108.2	104.7	109.9	103.8	94.0	94.5	103.3
October ...	86.9	78.6	91.9	95.8	100.9	100.8	91.5	107.1	105.6	110.1	103.1	93.1	96.0	100.7 (b)
November ...	88.8	83.5	94.6	97.1	100.0	101.3	94.2	106.6	105.6	112.3	100.5	94.1	95.5	103.0 (b)
December ..	89.0	84.4	88.8	96.3	101.3	104.2	95.6	106.3	103.9	109.5	101.6	94.5	98.5	—
Average ...	97.8	74.5	88.3	94.4	100.0	101.8	93.6	107.8	105.9	110.0	105.9	96.3	95.8	—

(a) Based on 11 out of 18 series.

(b) Provisional.

* This table shows the monthly figures. The index is also published in the *Economist* in the form of a three months' moving average.

The final stage of calculation was to take an arithmetical average of the eighteen series weighted as above. We were able to calculate eleven of the series for the years 1920 to 1923, and these were used with the same weighting to calculate a tentative index for these years. As the total weighting for these years is only 30, the distribution of weights is, of course, affected.

The figures of the final index are given on p. 256.

It will be seen that even though the more erratic series have been given smaller weights, the index is still a little "jumpy." We are therefore publishing it, month by month, in two forms; one the figures as above and the other a three months' moving average entered against the last month of the three.

One last point of calculation remains. It has already been mentioned that the majority of the American indices are related to a calculated "normal" progression. In the case of Great Britain it is virtually impossible to do this. The decade over which the figures extend is not in any sense a "normal" period. It comprises two depressions, one of them complicated by the coal stoppage of 1921, and also the General Strike and coal stoppage of 1926. Even the remaining years, 1924-25 and 1927-29, cannot be taken as "normal" without prejudging the insoluble problem of what would have happened if the gold standard had not been restored at the old parity in April, 1925. It is true that we have accurate figures of the growth of population and it would be possible to express the index on a *per capita* basis. But this adjustment would be very small and the conception of "business activity per head" has little more to recommend it than "business activity in the aggregate."

Discussion of the Index.

It will be apparent from the preceding description that the sources of data are so various and the methods of construction so simple, that the index must be its own justification. It is not possible to combine bank clearings with railway freight and claim statistical impeccability for the result. I have no doubt that the discussion on this paper will reveal a number of imperfections in addition to those already pointed out. My only answer and defence is to say that the index as it results resembles closely what we know from other sources that an index of business activity in the United Kingdom should be. The movement of the index is smooth and, except for exceptional periods such as the two coal stoppages, immune from violent, quickly-reversed fluctuations. In other words, its movements reflect those of just such a living organism as we know the economic life of a whole community to be. *Natura non facit saltum*; and our index confines its saltatory changes, as it should,

to those periods when Man rudely intervenes. The range of the figures from top to bottom is also approximately correct. It is true that the fall from the highest figure of 1929 to the lowest figure of 1931 is only 19·2 per cent. of the base (or 17·1 per cent. of the highest figure touched), which is less than the fall recorded either by the two British indices of production or by any of the American indices of business activity. Taking annual averages, since some of the indices are not adjusted for seasonal fluctuation, the percentage fall from 1929 to 1932 of some of the indices mentioned is as follows :—

U.K.— <i>Economist</i> Index of Business Activity	...	12·9	per cent.
Board of Trade Index of Production	...	16·6	„
London and Cambridge Index of Production	...	23·2	„
U.S.A.— <i>Annalist</i> Index of Business Activity	...	42·3	„
Babson Index of Business Activity	...	40	„ (approx.)
National Industrial Conference Board Index of Business Activity	...	53	„ (approx.)
Federal Reserve Board Index of Production	...	46·2	„

This discrepancy is considerable, but I am confident that it can be justified. The greater decline of the British indices of production is what should be expected on theoretical grounds. The discrepancy between the *Economist* index and the American indices can be explained in two ways. In the first place, the contrast between prosperity and adversity was greater in the United States than in Great Britain, as is illustrated by the very different behaviour of the indices of production in the two countries. In the second place, the American indices, as has already been pointed out, are very heavily weighted with industrial production, and consequently approximate much more closely to the character of indices of production.

It is possible, I think, to go further and maintain not only that the more moderate decline of our index is explainable, but that it is a much closer approximation to the truth than any of the more violent changes shown by the other indices. Amid so much unthinking talk of catastrophe and collapse, we are inclined to forget how relatively small is the margin between prosperity and depression. Our index sets out to measure the fluctuations of the “real” National Income. A useful check is therefore to be had in the fluctuations of the money National Income, which, in a period of falling prices, must have been larger. The National Income in 1929 is usually estimated at a figure between £3,800 million and £4,000 million. I do not think that anyone would place it for 1931 lower than £3,000 million. This is a decline, at the outside estimate, of 25 per cent. In the same period the cost of living index fell by 12·8 per cent. and the wholesale price index by much more. Correcting the maximum estimated fall in the National Income by the fall in the cost of living,

we get a maximum decline of "National Real Income" of about 14 per cent. This rough check tends to show that the decline in the *Economist* index of 12.5 per cent. does not at any rate err on the side of under-statement. The only estimates of the fluctuation of the National Income from year to year of which I am aware are those made by Mr. Colin Clark in his book *The National Income, 1924-1931*. Mr. Clark estimates that the National Income in 1929 was 111.4 per cent. of the 1924 level. Our index shows a rise of 10.0 per cent. Mr. Clark estimates that the decline from 1929 to 1931 was 12.4 per cent. of the 1929 figure. Our index shows a drop of 12.5 per cent. This correspondence is, of course, far too close for a comparison of "real" with monetary phenomena, and either one estimate or the other must be in error. But if it is our index which is wrong, the fault is that it shows too large, rather than too small, a decline. I therefore conclude that in spite of the movements shown by our index being so much smaller than those of other indices, any error which it contains is more likely to be one of exaggerating the swings of activity than the reverse. The difference between the highest month, November, 1929, and the lowest month, October, 1931, is one of 17 per cent. only. Allowing for the fact that this may be an over-statement, some idea can be gained of the narrow margin between the comparative prosperity of 1929 and the "crisis" of the autumn of 1931.

Economic Fluctuations in Great Britain, 1920-33.

It may be of interest to conclude this paper with a brief account of the vicissitudes of fortune in post-war Britain as they are revealed by this Index of Business Activity. Perhaps the most interesting question is that of the general economic progress of the community. How rapidly is our output of economic values increasing? To this question the index, as has already been pointed out, can give no definite answer. We know from general observation that 1920 was a year of unsound boom, and that 1921, 1926 and the years after 1929 were years of abnormal depression. What can be learnt from the remaining years? Most of 1922 was a period of recovery from the sharp slump of the previous year; the index was nearly 15 per cent. higher at the end than at the beginning. But the curve flattens out in the third quarter of 1922, and from then until March, 1925, the rate of increase is about 4.9 per cent. per annum on the average, being a little slower between June and September, 1923, and between May and December, 1924, but a little faster in the spring of each year. This rate of progress shows how rapidly the leeway of the war years and of 1921 was being made up. Had it been continued until 1929, the degree of activity at the turn of the Trade Cycle would

have been some 13 per cent. above the figure actually reached—as much above the actual figure as the pit of the depression was below it.

This satisfactory progress, however, received a severe set-back at the end of the first quarter of 1925. For the first time since the spring of 1921 the trend of the index turned definitely downward. Since the return to the gold standard was announced in April, 1925, it is very tempting to argue *post hoc ergo propter hoc*. But this would be a hasty conclusion, for in the autumn of 1925 the index turned once more sharply upwards and by April, 1926, it had more than regained the level of the preceding year. What would have happened thereafter we shall never know. The General Strike and the coal dispute intervened and were followed by a burst of activity in the early months of 1927. But from about April of that year to the end of 1928 the tendency was a definite downward drift. At the end of 1928 the index was only two points above the level of March, 1925. 1929 brought a sharp rise in the early months and a maintenance of the level thus reached throughout the summer and autumn, but the average rate of progress of the six years 1924 to 1929 was only about 1·8 per cent. per annum. This is without doubt an unsatisfactory record. There are those who will ascribe it all to the over-valuation of sterling consummated in 1925. There are others who will blame it on the effects of the labour disputes of 1926 and the lesson which was then learned that wages could be reduced only with the utmost trouble. The index cannot decide between these rival schools of thought. It can only record the disappointing facts.

The depression did not manifest itself in this country until at least four months of 1930 had passed. The index for April, 1930, was above the average for 1929 and within two points of the highest reached. Thereafter, however, the descent was very rapid. The index fell $7\frac{1}{2}$ points in three months and in November was 8·8 per cent. lower than in April. In the late spring of 1931 there was some evidence of stabilization and even of recovery. The three months' moving average, which had fallen virtually without interruption for thirteen months, recovered from 97·2 in April to 98·1 in July. This recovery in the second quarter of 1931 has been rather forgotten in view of the events of the autumn and it is of interest to notice that of the eighteen component series only five were definitely lower in June and July than in January. Whatever promise these months held out was never performed, for first the political and then the currency crisis supervened and the index plunged down more rapidly than ever. This renewed descent was, however, not prolonged, for the recovery started before the end of the year. The reaction from

the first shock of the crisis, the relief from the depreciation of sterling and the impact effect of the first batch of protective tariffs all played their part in this upward movement. This rapid recovery lasted until April, 1932. The twelve months from April, 1932, until April, 1933, showed on balance no change, the third quarter of 1932 being a period of decline and the fourth quarter one of recovery. Beginning in the second quarter of 1933, however, there has been a rapid recovery, the three months' moving average rising 5·7 points in seven months, or at the rate of about 10 per cent. per annum. Whether this rate of improvement can be maintained is a question for future months to answer. We have now, for the first time since January, 1931, exceeded the 1924 level of activity. We are still, however, some 16 per cent. below the trend of 1924-29 projected into the future, even though the rate of progress in those years was so disappointing. Since the tide turned in November, 1931, the index has advanced at the overall average rate of 4·3 per cent. per annum.

Conclusion.

The foregoing pages have described in some detail the construction of this index. I can only say in conclusion what was emphasized at the outset, that we make no claims of statistical perfection or of theoretical infallibility for our index. We regard it rather as a pioneer attempt to make this particular variety of bricks with a scanty and indifferent supply of straw. We have improved the methods of calculation since the index was first published and we shall be grateful for any suggestions for further improvement. But our greatest hope is that in the next few years the starvation diet upon which statisticians in this country are at present forced to subsist may be transformed into the relative plenty of America. When that time comes, I hope to be privileged to describe to you the *Economist* weekly index of business activity.

DISCUSSION ON MR. CROWTHER'S PAPER

MR. MACROSTY: To obtain a single measure of business activity is a great quest which, despite its manifest difficulties, has attracted many persons, and we must admire the gallantry with which Mr. Crowther and the *Economist* have tackled the problem. This Society is further indebted to them for the readiness with which they consented to come and discuss their results with us. In your name I tender them our thanks and shall ask you a little later to signify your agreement in the usual manner. Now, we have always held here that criticism is the truest praise, and so I shall proceed at once to offer some suggestions and to propound some questions.

"Consumption of coal." Output less exports and coal used in iron and steel-making does not allow for stocking of coal in merchants' hands at the beginning of the winter season except in so far as this can be done by smoothing out the seasonal movement. Coal used for electricity should also be deducted to avoid duplication.

"Consumption of electricity." I cannot say that I am satisfied that full allowance has been made for the gradual transfer from private to public generation and other forms of power to electricity. Perhaps the Census of Production figures might help in this, though the intervals are rather long.

"Merchandise on railways." In recent years this figure gives an exaggerated view of trade depression owing to the loss of traffic in general merchandise to road-transport by motor.

"Consumption of iron and steel." I note that steel is to be substituted for pig iron as a base. This is imperative on account of the great increase in the use of scrap for steel-making since the war, but the conversion of imports and exports of manufactured iron and steel goods (even if machinery is excluded and only plates, sheets, shapes, sections, nails, tubes, pipes, wire, and similar goods are included) into pig iron or steel is, as I know from my own past experience, a very hazardous operation, involving grave risk of error.

"Consumption of cotton." I should much prefer as an index the daily despatches of cotton to mills (ascertained by the Liverpool Cotton Association) to net imports corrected for changes in stocks. I see this is now to be done.

"London Bank Clearings." The inclusion of the "Town" clearings, representing Stock Exchange and other financing, unfits the aggregate of London clearings to be an element in the index sought for. Only "Metropolitan" and "Country" clearings should be taken, and it would be better if they were combined with "Provincial" clearings to form one component. But I do not know any reason why even this restricted amount of clearings should be composed half of wholesale and half of retail dealings, as is implied by the use of the mean of the wholesale and retail price index-numbers as a price corrective.

Lastly, it will be observed that while most of the components of the index reflect current or, at least, recent production, the two import items indicate future, and the export item past, production while bank clearings relate to a mixture of past, present, and future.

More important than these details is the question of weighting. Statisticians are wont to comfort themselves with the reflection that weights are of minor importance in the composition of a combined index, but that is only true when the items are all subject to a common influence (which we have in a business index) and when the items are numerous. Here there are only 18 items of which one contributes nearly a quarter of the weighting. Further, there is duplication or, at least, overlapping between most of the items; for example, the home production of goods is already registered in the employment figures. Nor do I understand the "inherent

tendency to violent and arbitrary fluctuations" attributed to Cotton which so much degrades its importance.

Going back to the four series of indices for employment, I think it is an unnecessary complication to add an index for all trades to the indices for the three divisions (quite properly made) of "heavy," "general," and "distributive" trades. Two minor alterations I would make: the transfer of public utilities to the "general" class where they properly belong, and the description of the third class as "distributive trades and services," including, of course, transport. But it is more important that the traffic staff of railways is excluded from unemployment insurance, and that a number of persons, of the order of 600,000, is absent from the transport figures. If these corrections are made and all mining and quarrying, instead of simply coal-mining, is included in the heavy class, we have the three classes weighted as follows on their respective numbers:—heavy 28, general 42, distributive and services 53, or roughly 3, 4, and 5 out of a total of 12.

We can combine items in a common index-number by weighting them according to some common element. Thus, in an index-number of wholesale prices the weights represent the relative importance of the several components (and the industry groups behind them) in the national consumption as measured by their money-values at a particular time. But what common element have we in this Index of Business Activity? What is there in common between 1,000 persons at work in all trades, 1,000 tons of pig iron, 1,000 Board of Trade units of electricity, and a cheque for £1,000? It cannot be price, for in 1924 the total of bank clearings was about eleven times the national income, and bank clearings are only given a weight of 7 out of 46. The weighting must be arbitrary, and the only justification I can see is that which has been given in defence of other similar indices, namely, that "it works." But any index, so constructed that a quarter of its weight was represented by employment and that movements in employment were bound to be reflected to a greater or less extent in components making up about half the total weight, is bound to show with a considerable degree of accuracy the direction in which change in activity is taking place. Whether it would register the magnitude of those changes with sufficient precision to enable one to make reliable forecasts of the continuance of a particular change is another and much more doubtful question. Personally, I should prefer to rely primarily on the index-number for employment divided into the three classes, remembering that the deduction of the "unemployed" from the total insured leaves, as apparently employed, about 420,000 persons ($3\frac{1}{2}$ per cent. of the number insured) who at any time are absent sick or voluntarily but cannot be distributed among the different industries. I should also remember what Mr. Dale told us at the last meeting of the "influence" of "an increased appreciation of the possibilities of getting relief" and of changes in the insurance scheme as producing changes in the numbers shown as unemployed without any real change in the amount of work. Therefore, I should try to confirm or correct my impressions by a study of the

other indices which the *Economist* publishes. That would be more laborious than consulting a single composite index, but, at least, it would produce more confidence.

I have much pleasure in moving a hearty vote of thanks to Mr. Crowther and to the *Economist*.

SIR GEORGE PAISH: I have much pleasure in seconding this resolution. Mr. Crowther has put a great deal of work into his paper, and we are very greatly indebted to him for the result. The result, as far as my own experience goes, is not altogether satisfactory. The whole subject needs to be elucidated in much greater measure and I rather agree with what Mr. Macrosty has said about the weighting of the various items.

I used to take railway earnings as my own barometer of trade for many years. I used them because on the whole there were very few fluctuations in freight rate or even in passenger fares, and so one had a constant or relatively constant price, and railway earnings thus reflected in a comprehensive manner the aggregate trade of the country from year to year.

When one examined the figures in times of depression it appeared that the reaction in the volume of trade was extraordinarily small. This paper confirms the result of my own investigations, namely, that the fluctuations in the real income of the country in periods of trade depression are relatively small. According to the investigations I made into the trade reactions that occurred from 1870 onwards, I could not discover that the real income of the nation ever went down more than about 3 per cent. in a period of depression. There was a greater increase in unemployment, because the depression was extended over several years, and population increased in these years. Further, the trade depressions affected some industries more than others, and these industries were usually to some extent reorganized and staffs reduced, in consequence of which unemployment increased out of all proportion to the diminution of trade.

It was very interesting to see, however, how this surplus labour was re-employed when trade recovered. I suggest that if Mr. Crowther could find two or three items that would be comprehensive and did not overlap, it would be an advantage.

Motor traffic has now come in to disturb the traffic figures in a serious manner, but it might be possible to cause the Motor Companies to make returns of their traffic in the same way as the Railway Companies. I do not see why Railway Companies should be asked to give all the data they have to give under statute while Motor Companies are expected to give none. If we could get the transport figures by railway, motor and steamer, they would give a very good idea of how the trade of the whole country was moving from year to year and from period to period. Apart from that, the data are of distinct value, and the errors tend to adjust themselves.

I therefore second this vote of thanks with great pleasure, but I would add one thing—a matter of moment. The data must not be regarded as more than a thermometer; it must not be presumed that the weather is going to be fine to-morrow because it is fine

to-day. It is necessary to ascertain the underlying causes of a trade improvement to know whether that improvement will continue, and conversely of a trade reaction to know if it is likely to last.

As illustrating the importance of not accepting a trade thermometer as a necessarily true indication of what is likely to happen, I may mention that in the spring of 1929, various people came to this country from America to try to persuade us that the trade improvement in America would continue; they brought with them elaborate charts showing trends and curves of actual trade, and from these charts they drew the conclusion that inasmuch as trade had expanded in the way it had from 1900 to 1928 it might reasonably be assumed to continue to expand indefinitely in the same way. Those charts undoubtedly caused the American Government and American business men to form totally erroneous conclusions. They had no knowledge of the underlying factors which had brought about the improvement, or the underlying factors that inevitably would cause the present extraordinary trade depression.

It is essential to use these figures as a weather chart is used. We see the barometer "set fair," but we have the Meteorological Office to tell us what the weather is likely to be during the next few days, as it possesses much more information about the atmospheric conditions over a wide area than is conveyed by the barometer.

I hope the *Economist* in future will accompany its very valuable information with meteorological advice, giving not only the factors that are responsible for the position of its index at the moment, but the factors likely to affect the course of its index in the future.

I have great pleasure in seconding this resolution.

MR. LEAK said he would like in the first place to congratulate Mr. Crowther upon the courage which he had shown in compiling the first index of business activity for the United Kingdom. He could appreciate the enormous difficulties confronting anyone who undertook such a task. Mr. Crowther had asked for criticism with a view to improving the index, and Mr. Leak said that later on he would have some criticisms to make on a few of the individual series: at the outset, however, he would like to ask whether it was really an essential condition that all the series should be available monthly? The figures given in the table on p. 256 showed that for the last two months the figures were provisional. If the figures for three months were made provisional, they could be corrected by the general index of production, which covered a far wider range than any of the series here included. General employment figures could not be regarded as a satisfactory substitute for a general index of production. Mr. Leak had come across a case only a few days previously where an index compiled from the Ministry of Labour figures with great care—allowance being made for short time, etc.—differed over the period 1924–30 by no less than 13 per cent. from the Census of Production figures; not only so, but the quarterly variations in the production and the employment index showed very wide fluctuations. This was a point of very consider-

able importance that should be borne in mind by everybody, that the employment figures and production figures did not always march side by side.

Mr. Crowther lamented the absence of any retail trade figures. Seeing that food formed a large proportion of the goods sold retail, it might perhaps be worth consideration whether retained imports of food-stuffs might not form one of the component series, at least until a better series representative of retail trade was available. Incidentally that index would match those already included for the imports of raw materials and exports of manufactures, and the three series would balance.

With regard to the particular series, Mr. Leak would not be inclined to attach too much importance to "Postal Receipts," though it was a nice even series, in view of the extent to which they might be subject to distortion as a result of variations in the amount of newspaper and other competitions. The 6*d*. entrance fee for some of these competitions would necessarily be included as "Postal" receipts, and the actual postages would not be entirely negligible.

As regards the "Building Activity" index, he would question the assignment to dwelling-houses of a weight double that of other buildings. The indications of the Census of Production were that the weights of the two classes were about equal. The Ministry of Labour figures did not show that relationship, but then they excluded London, and such an index was not fully representative. It was indicated in the paper that the *Economist* proposed in future to take the gross figures of the Ministry of Labour, but Mr. Leak suggested that it would be well to subdivide them, as at present, and to weight the figures equally.

On p. 252, Mr. Crowther stated that the "Movements of Shipping" included entrances and clearance of foreign-going ships and the general coasting trade of Great Britain: but the trade with Northern Ireland and the Irish Free State was omitted. In the first place, why omit that section of the trade? Surely it was of a nature intermediate between the coasting trade and the foreign trade. Secondly, the figures published monthly that had been used related to the entrances and clearances of foreign-going ships but to arrivals and departures of coasting ships. Arrivals and departures of vessels in the foreign trade were much more numerous than entrances and clearances. Not only was the shipping index used compiled by adding together like with unlike, but a trip across the Bristol Channel was given the same importance as a long journey from Australia to Great Britain. The coasting trade was given too great a weight relative to the foreign trade, and the index as it was at present compiled was in need of serious amendment before it could be considered a representative series.

In conclusion, Mr. Leak said he would be glad if Mr. Crowther would explain how the index for the consumption of electricity was corrected by an index of a number of new connections.

MR. L. A. MUNRO said there was one aspect of Mr. Crowther's paper which interested him particularly—this was the appeal for

more statistics. Everyone was familiar with the lack of information to which attention had been drawn, but one side of the question was apt to be overlooked. People were prone to blame the Government Departments for not producing information, but surely it was largely a matter for private enterprise, and he would like to suggest that, possibly, an appeal addressed to industry by the Royal Statistical Society might succeed in making industrialists realize the importance of letting loose all the information they could.

He did not know if there was anyone present who was interested in oil, but if so he would like to hear his views on the suggestion that figures of the consumption of lubricating oil would probably be the most useful information that could be obtained in dealing with this type of index. The quantity of lubricating oil used in industry must be a measure of almost every kind of industrial activity, and would also give a measure of almost every kind of transport, and thus, in itself, provide an index of great value.

DR. ISSERLIS said that before coming to the subject proper he would like to emphasize what Sir George Paish had said about the multitudinous series of statistical data available in the United States and of the great use that had been made of them since about 1920 for the preparation of various indices and for use in forecasting and so on. They had been warned quite correctly that this plethora of statistics, when not accompanied by proper precautions, had led business men in the United States into serious error, and he would emphasize the point at this stage, because the last speaker had said something about the Royal Statistical Society making an appeal to industry for still more statistics to be available for various purposes. He thought very great care was needed before giving publicity to this demand for more and more statistics, because time and energy could be very well occupied in trying to improve the quality of the statistics that were already available. He was rather afraid of an embarrassment of riches that might come upon statisticians if all kinds of collections of statistics were thrust upon them.

Referring to the subject of the paper proper, Dr. Isserlis joined with those who had already spoken in congratulating Mr. Crowther upon his courage and upon his industry in giving this new index. He did not think that Mr. Crowther expected to be congratulated upon his success, because he would hardly expect this first effort—which was in the nature of a pioneer effort—to be as successful as it would be when the compilers had had time to work on it longer and to improve it, but he was struck by the fact that after having laid down the object that the compilers had in view, this object was departed from almost immediately. After all, it was to be not an index of production, but some measure of the economic activity of the nation. The fact that an attempt to measure the economic activity of the nation was almost at once given up was shown by the title, “A Measure of Business Activity,” and while business activity was a different thing from production, it was not exactly the same thing as the sum-total of the economic activity of the

nation. It was, of course, manifest that the total economic activity of the nation did fluctuate very much less than these various indices of production or of business activity that concentrated on the things that were measured by available statistical series. If one looked at the Ministry of Labour's totals of insured persons at the moment the number of males was about 9·3 million, but the number of insured females was only 3·5 million. If he had understood Mr. Macrosty correctly, it would appear that another 600,000 women would have to be added in order to get at the number of females gainfully employed, including those employed in agriculture. To the 3 or 4 million females 5-6 million females would have to be added if the figure was to represent those usefully employed in the home. There was a gap of 5-6 million females of much the same age as the males, not represented in employment statistics at all, and whether at the depth of a slump or height of a peak, these women were just as much employed, whether in ornamenting themselves for the pleasure of men, or in performing household duties, as the others.

In the total activity of the nation many unrecorded things mattered. It might, for instance, be important that one should have leisure to prepare papers to read before the Royal Statistical Society, and so on.

With regard to the individual components of the index, he quite appreciated that components which were themselves difficult to estimate and to weight, and were subject to error, might, when combined, cause the errors to compensate one another and give a reliable and stable measure. But the shoemaker must stick to his last, and Dr. Isserlis could only speak of those components with which he was particularly familiar.

Mr. Leak had drawn attention to the lack of homogeneity between entrances and clearances of vessels in the foreign trade, and arrivals and departures in coasting trade. That might be pardoned; one might say that one ship in the coasting trade did as much work in a period as another on a single foreign voyage, but the difficulty was greater than that. Of about 15 million gross tons of shipping engaged in the foreign trade before the war, 10 million were in the nature of tramp shipping, and 5 million in liner shipping. To-day, 10 million was liner, and 5 million tramp. The tramp ship used to come and go with a full cargo if it went on a trade voyage at all. The liner moved very often with only a 5 per cent. load; it was quite happy when it had a 30 or 40 per cent. load, so that the fact that entrances and clearances in foreign trade in 1932-33 were much the same as 1913 or 1924, really told nothing as to whether the activity with which that movement was correlated or the employment of those ships themselves was the same in 1932 as in 1913 or 1924. He wondered that Mr. Leak had not reminded them that even with the figures as they stood, the entrances and clearances in the foreign trade in 1933 were not strictly to be compared with those for the year 1931. There was an alteration in the base of the statistics. The figures for 1933 could be compared with those for 1932, but not with those for 1924-31. Possibly the other series

presented similar difficulties. It was the statistician's last resort—to hope that the errors in the various series would eventually compensate each other. He did appreciate this addition to the forms of economic index already at the disposal of statisticians as a valuable asset, and he was grateful to Mr. Crowther.

MR. NORMAN CRUMP said he would like to begin by explaining that while he had the pleasure of being a colleague of Mr. Crowther's on the *Economist*, he had not actually been associated with this work; he therefore felt free to express himself on this subject. In actual fact he had come to the meeting thinking it would be more pleasant for him to make a speech on behalf of the prosecution; but now he proposed to speak entirely for the defence.

The first thing to be remembered was that in making up these figures and in presenting them, the professions of a statistician and a journalist were being combined; the work had to be presented and interpreted in such a form that even lazy readers could seize upon it and understand it, and that was why he thought it was necessary to combine these various data into one figure, even if there were various well-founded objections to so doing. He spoke with a certain amount of experience, because for several years he had been engaged in interpreting the components which Mr. Crowther had now joined together, and he found it was difficult to build up something which a reader could seize hold of and say, "That is the position at the moment." On the other hand, the reader could appreciate a single figure, and it was the journalist's duty to say, "This figure is merely a presentation of things past and no measure of things to come." This was the easiest way of getting the story across.

With regard to criticisms, Mr. Macrosty had really forestalled him. However, he had been kind in exchange, and here Mr. Crump came to his brief for the defence. There was one passage in Mr. Macrosty's speech in which he implied that Mr. Crowther used too few items for it to be possible to arrive at adequate weighting. Sir George Paish took the view that on the whole two or three big items would be better than the eighteen used by Mr. Crowther. Mr. Macrosty therefore implied that Mr. Crowther used too few, and Sir George Paish that he used too many items; Mr. Crump said that he would not himself attempt the extraordinarily difficult statistical task of assigning weights to these two criticisms, still less of computing their average or combining them into a single figure.

Mr. Leak had made one or two interesting suggestions—first that Mr. Crowther should publish provisional figures for the last three months, instead of the last two months, because, if so, he could improve his results as time went on. The weak point was that each time the index was brought out a certain number of people seized the latest figure as official and plotted their own graph solely from these figures, which were provisional. For that reason he deprecated publishing provisional figures unless it was unavoidable.

Mr. Leak also suggested the use of retained food imports, and

the moment he said that, Mr. Crump thought of Mr. Macrosty's point that raw material imports represented the promise of things to come, while finished goods exports represented the achievement of what was actually past, that raised the whole question of the time lag in these series. When he thought of the millions of things imported under the guise of food-stuffs, some of which would keep for a long time and some not at all, it would frighten him to regard the figures of each month as indicative of the state of business in that particular month.

With regard to newspaper competitions, Mr. Crump and Mr. Crowther had once shared a building with a well-known newspaper which indulged in this form of amusement, and they repeatedly saw 10 or 20 persons sit down at two long tables in the basement and proceed to open hundreds of envelopes. He had also been in the sorting office of one of the London Postal Districts, and if one put that one room, representing one newspaper, against the sorting office of one London Postal District, he would say that the influence of newspaper competitions was negligible. It did occur to him, however, how far advertisements, circulars, catalogues and all the rest of the stuff sent out by distributors, manufacturers and others, might be an element in the total postal returns; if they turned out to be an appreciable element, he would like to ask Mr. Crowther what interpretation he would place upon that for the purpose of his index.

There was one other point: the question of seasonal correction, which brought to light the old trouble about index-numbers which had been thrashed out time and again in the past, and would be thrashed out again in the future. How long did an index-number keep? The particular point he had in mind on this seasonal question was that certain seasonal fluctuations took their origin from the incidence of the year's crops, and in normal times a crop, as soon as it was gathered, was marketed and moved into consumption. In these days, however, that did not hold good, because, owing to the existence of huge carry-overs, every manufacturer could spread his purchases over the whole of the year. He had been told in the foreign exchange market last July that this year they were not under the stress of seasonal pressure for dollars, because the Western American crops were being marketed all the year round, owing to the existence of this huge "carry over." It might be that seasonal corrections based on past and more normal years were not quite applicable to-day.

Mr. Crump said that in conclusion he would like to throw out one idea. Mr. Macrosty had said it was difficult to assign weights to a number of independent components that had nothing in common. Mr. Crump suggested that they had this much in common—that each and all represented an attempt to make a shot at a target and to hit the bull, and, on the principle of firing to get a good "group," they could be regarded as having something in common, and weights could be assigned to them. It was necessary to do the best one could with the limited material at one's disposal, and to put it in language which readers could understand and interpret. It was necessary

to avoid the trap mentioned by Sir George Paish, and to say, "These figures mean so much and no more; they refer to the past and present and not to the future." If they were used for the future, it should be with due reservation.

DR. ELSAS said that he had been particularly interested in this paper because he had tried for many years to compile indices of a similar kind, and he had seen the pitfalls and difficulties connected with them. He was very grateful to Mr. Crowther for his paper, and felt that he could add little to what had already been said.

He quite agreed that an index which only contained a small number of items could be better than an index of numerous items, if well chosen; but if one chose one component, it was essential not to forget the relevant supplement; for instance, if cotton consumption were put into the index, artificial silk should not be omitted, for when one was moving the other need not move, and the omission might tend to misleading results.

Another point for consideration with regard to the index was the import of raw materials, which only held good on the assumption that the stock of raw materials in the country was always the same, but that was very seldom the case. A point of minor importance was the coal consumption, and here it was necessary to point out that if coal could be more fully utilized it would have a different importance.

With reference to weighting, Dr. Elsas did not see the reason why merchandise on railways should have more importance than that carried by motor. Motor transport was a supplement to railway transport. Why, then, should the weighting of one be double that of the other?

The chief thing about weighting was the figure for employment. This was 11, which meant 24 per cent. Personally, Dr. Elsas thought that was too small, and suggested doubling it. It had been shown in a study of American conditions of "the purchasing power of the consumer," * that the curve which best reflected the business activity was the purchasing power of the working classes. That was not a mere coincidence, but could be shown as theoretically sound. Perhaps one should divide the index into an index of production and an index of consuming power of the masses. If a better definition of what a business activity index should represent could be found, one might reach a different theoretical basis.

MR. STANLEY JEVONS said he would like to say a word about weighting. He belonged to those who regarded the total of bank clearings as a very good index of the total economic activity of the country, and it did seem to him that if that total could be freed from investment and stock exchange transactions, such as the conversion of war loan and speculative activities during boom periods, those clearings themselves would provide a good index of business activity. Would it not be possible to correct the bank clearings by getting the net totals of the clearings of securities at settlement

* Berridge, Winslow and Flinn.

days of the stock exchange? If that were done, he, personally, would be disposed to regard the total of bank clearings as of equal value with the whole of the rest of the components of the index-number. There would then be two parallel indices, one composed of the items employed by Mr. Crowther and any others that could be obtained, and the other solely the bank clearings; and in making a single combined index of business activity he would give them a fifty-fifty value.*

MR. O'BRIEN said he would like to make a few remarks upon the purely theoretical side. Supposing all the corrections suggested were made in the index-number, what would it ultimately mean? He wished to abstract from the purely statistical difficulty of decomposing the series into trends, etc. He would assume that there had been separation and that this separation was logical; and that there was thus a large number of series showing changes over a period of time which had to be combined into the index. It appeared to him that index-numbers were of two types. In the first a true value had to be found. The only real instance he knew was the change in the cost of living, and the measure was an attempt to reach a real value. He thought it was also possible that that concept could be extended to national income, so that they could get an index-number that purported to measure that, but which could only refer to consumption goods and services. He could not see much point in comparing Colin Clark's estimate of the national income corrected by a cost of living index-number, with what amounted to an index of total production by all kinds of activity, which covered much more than such goods and services.

The second concept was a statistical one. There was some force which acted upon the number of variables. Two questions has to be asked:—

(1) Is an average justified? and (2), a related question, Are the data homogeneous?

If, for example, half the prices of a number of goods rose by 30 per cent., and half fell by 20 per cent., could we attach any sense to a change in the "price level" of all those goods? In the second instance, the wages of skilled and unskilled labour would not be put together in a single frequency distribution. Surely the concept under consideration belonged to the latter of the two distinguished; they conceived that there was a cyclical force which changed these series, and before giving an average they should study the distribution of the separate facts in order to find whether an average was justified. That might be in practice impossible, but Mr. O'Brien thought there was at least some theoretical basis for separating activity indices into those dealing with consumption goods, and those dealing with producers' goods. Among their manifold differences one could discern that point of agreement in the controversy between Mr. Keynes and Dr. Hayek, and statistical measure-

* After the speaker had sat down Professor Lionel Robbins said to him that the weekly totals of issues and payments of Treasury bills should also be deducted from the total bank clearings, to which the speaker assented.

ments to be of use should be put on a sound theoretical basis. Mr. O'Brien conceived the *Economist* index to be a purely arithmetical result, and he could not conceive of railway returns, postal receipts and such-like aggregates being of any use in discovering organic differences.

He would like to add a word on weighting. He thought the choice of weights was a purely statistical consideration dependent upon such matters as tendency to fluctuation, and if the average was justified, and one was justified in printing something as an index of business activity, there would not be much difference in the result whatever the weights. He could not conceive that in this type of index, apart from considerations of sampling, there could be any question of it being correct. On p. 258 references were made to the index being accurate or better than something else; for example, "The range of the figures from top to bottom is also approximately correct." This was a type of thing that Mr. O'Brien failed to comprehend. Actually the disparity between the different measurements seemed to indicate that one figure for business activity was not justifiable. The final conclusion was that if one picked up the *Economist* and found that their index of business activity had risen by, say, 10 per cent., it was not possible to say to oneself that business activity of the last month had gone up by 10 per cent., because that had no meaning; it could not be said that though activity in different spheres had changed differently, this 10 per cent. was a useful descriptive average. It was merely an arithmetical result which did not appear to have any particular usefulness.

MR. HARGREAVES PARKINSON said that on the non-technical side of the subject he thought the Fellows might be interested to hear some of the historical antecedents of this index. The story went back to the year 1923, when he had joined the staff of the *Economist* and became responsible for the *Economist* monthly supplement on the state of trade. He found Sir Walter Layton deeply imbued with the feeling that British trade at that time was very much better than the current impression.

In these comparatively enlightened days it was difficult to realize the dearth of current statistics bearing on trade activity ten years ago. In 1923 there was no Census of Production of which the complete results had been published since 1907. The calculations of Dr. Bowley and Sir Josiah Stamp on the national income had still to be made, and were, in fact, published some years afterwards. Mr. Flux's Index of Industrial Production was started about five years afterwards. The first post-war Census of Production was taken in 1924, and the results were actually available from 1928-29 onwards.

In 1923 the country was emerging from a very severe depression. The figures available at that time, on which impressions of business activity were chiefly based, were the returns of production of coal, pig iron, and steel ingots, and the overseas trade figures, particularly those of British exports. In other words, practically all the then current statistics related to the more depressed industries or branches

of trade, and tended seriously to under-estimate the volume of business activity. Accordingly, special attention was given, as a first step in the *Economist's* monthly supplement, to the business of collecting reports from industries, bearing on such *current* questions as the volume of new orders, etc.

In 1924 a Labour Government came into power. Mr. Ramsay MacDonald, the Prime Minister, appointed the Colwyn Committee on National Debt and Taxation. Mr. Parkinson thought that the Fellows would find the present index in embryo in the evidence-in-chief of Sir Walter Layton before the Colwyn Committee. By collating the figures, now represented in a few of the groups of the *Economist's* activity index, Sir Walter succeeded in conveying the impression that the volume of national activity, at that time, made a far less unsatisfactory comparison with that of 1913 than had been popularly imagined.

From 1924 onwards, a definite effort was begun to collect and collate as many figures as possible which appeared to fluctuate directly, or more remotely with the volume of general business activity. These figures, which the *Economist* began to publish regularly each month, a year or two later, were designed mainly to give readers, particularly business readers, the earliest possible intimation of broad changes in the industrial trend. Naturally, the figures in these early days were something of a hotch-potch, but it was found that their juxtaposition month by month certainly tended to give readers an inkling of important changes in the volume and direction of figures much earlier than would have been otherwise possible.

When he left that side of the *Economist* the matter was still in an experimental stage, and he had not been personally concerned with the compilation of the figures for the last five years. He took it, however, that the object of the figures still was, not to replace or refute any other index, but to give the readers of the paper the earliest possible intimation of how the seething mass inside the pot was boiling up. More than that would hardly be claimed for it at the present stage.

MR. CROWTHER, in reply :—As for the many very valuable and interesting comments made on matters of detail, I have no wish to go into them at this late hour, except to say that we are very grateful for them. On the more general matter of the compilation of this index, I was well aware that in accepting the invitation of your Secretary to come here to-night, I was adopting the position of one who attempted to expound the composition of a patent medicine to the General Medical Council, but I am still of the opinion that this index, imperfect though it is, inaccurate as it is, incorrect as it may be, is still worth publishing month by month.

I cannot reply to all the criticisms made, but a few comments on one or two may not be out of place. To start at the beginning, Dr. Isserlis suggested that in calling it an Index of Business Activity we were departing at the outset from our task of measuring the whole economic activity of the nation. I can only quote Marshall, who

said that economics is the study of Man in the ordinary *business* of life.

One critic said it was not possible to compile an index of business activity. In the narrowest statistical sense of course it is not possible, nor is it possible in that sense to compile an index of prices or of anything.

Many of the comments made seemed to be in essence a declaration of the statistical impossibility of composing such an index, because the difficulties were too great; they were expressions of statistical defeatism. That must remain a matter of opinion. We at the *Economist* feel that it is possible to compile an index of business activity, and that it is a thing that needs doing, that it would be welcome if it could be done, and worth doing even if one could only make an attempt at it.

It has been suggested that various single indices would provide a better measure than any combination. I take the liberty of differing in every case. Speakers have nominated for the purpose various of the component indices, and I feel that if we had had enough speakers we would have had a champion of every one of the eighteen contained in the index.

With regard to the suggestion that the employment figures would give a satisfactory measure of economic activity, Mr. Leak pointed out that in fact they did not vary as did business activity. Professor Elsas suggested that we should use as our measure the purchasing power of the working class. I have experimented with that, but in fact it gives the most extraordinary results. Let me mention one:—If we take Dr. Bowley's Index of Wages, correct it for the cost of living, and make a further correction for the unemployment percentage, on the assumption that the amount paid out in unemployment insurance benefits is, on the average, half of the standard rate of wages, that ought to give the purchasing power of the working class. Actually the figure for 1932 is higher than any previous year, which would seem to be contrary to common sense. That is the kind of thing that happens if you take one index alone.

As to the way the index has been put together, Mr. Crump has pointed out that we have been criticized for including too many and too few indices; accused of using indices that overlap, and those that have nothing in common. Both these criticisms cancel out. As to the method of weighting, I am unable to see the objection to overlapping; if I may use Edgeworth's analogy, the shadow of a small tree will show the direction of the sun as well as the shadow of a big tree. In effect we are taking eighteen series of figures which we believe, in all their imperfections, are the best measures available of the kind of way the activity of the country is going, up or down. We have weighted them—admittedly in an arbitrary way, but in the best way we can devise—and we say "Here is the result." We do not say that it is an exact measure of the degree of business activity but if our index is as good a measure of the variations of business activity as any wholesale price index is of the variations in the value of money, we shall feel that we have accomplished our task.

I was particularly struck with the fact that (apart from the criticism—which I thought was a little too pessimistic—that it is illogical to talk about the “correctness” of this index) none of the speakers suggested that our index is not a close approximation to the actual movements of activity in this country.

My final suggestion is that any one who accepts the hypothesis from which we started, that it is possible to do a thing of this sort, should himself sit down and see if it is possible to produce an index which he can show to be a better index of activity in this country since the War. I do not believe it is impossible, although we have good reason to know the difficulties which lie in the way, and if it is accomplished, we shall be the first to rejoice.

Among the points of detail, comment may be made on two suggestions made by Mr. Leak. The first is the suggestion that, as the last two months in every case have to be calculated provisionally, it might be worth while to wait one more month and include some of the data which are available quarterly, notably the figures of the Index of Production. If these quarterly indices were published within a few days of the end of the three months to which they refer there would be a great deal to be said for this suggested addition. Unfortunately, the figures are not published for some two months after the end of the quarter (the figures for the last quarter of 1933, for example, appearing at the end of February, 1934), and the adoption of the suggestion would consequently mean leaving the index in a provisional form for five months.

The second point is the suggested inclusion of an index of imports of food-stuffs. The objection to this is that tariffs and quotas are likely to play such havoc with our imports of food-stuffs that such an index would be a very poor guide to the movements of the consumption of food. The same objection applies, of course, to the index of imports of raw materials, but not to the same extent.

As a result of the ballot taken during the meeting, the candidates named below were elected Fellows of the Society :

John Brady.
Harry Campion.

and PROFESSOR EMILE BOREL, of the Faculty of Science, Paris, was elected an Honorary Fellow.

EXCHANGE STABILITY VERSUS INTERNAL PRICE STABILITY

By PROFESSOR J. H. JONES, M.A., of the
University of Leeds.

[Read before the Royal Statistical Society, February 20th, 1934,
The PRESIDENT, THE RT. HON. LORD MESTON OF AGRA AND
DUNOTTAR, K.C.S.I., LL.D., in the Chair.]

Introduction.

TEN years ago nearly all the countries of the world were employing paper standards or national currency standards. Austria, Germany and other countries either had passed, or were passing, through a period of fantastic currency inflation. Most of the countries were suffering from serious industrial depression which was mainly due to the war, but which was commonly believed to be partly due to currency disorganization. It was believed that industrial stability and progress would not be restored until the world had returned to the gold standard. In the years that followed one country after another returned to gold, and for a period of five or six years the gold standard could be regarded as the international standard in the sense that it was employed by nearly all the countries that really mattered from the industrial point of view. It is now clear that the world was not ready for the gold standard. Most countries have returned to paper standards, and it may be that before the currency tangle is straightened out, those European countries which are still attached to gold will have joined the majority.

It was therefore natural that the Council of the Society should decide to devote one of its meetings during the current session to a discussion of the subject of this paper. At the meeting of Section F of the British Association at Leicester I ventured to devote the Presidential Address to an examination of the gold standard; and in that address I stated as clearly as I could my own views on the subject. It is presumably for this reason that I have been invited to open the present discussion. One of the chief difficulties with which I was confronted in the preparation of this paper was that of determining precisely what I was expected to discuss. No one who has followed discussions of monetary affairs during the last ten years can have failed to observe that these have frequently suffered through failure to define the issues. I may therefore be forgiven for devoting

a lengthy introduction to a statement of what appears to me to be the real issue involved in the present controversy.

The word "stability" appears twice in the title of my paper, but it is employed in two different senses. A stable exchange obviously means a fixed exchange, and a fixed exchange implies the use of an international standard. The real economic significance of the gold standard, which I shall use to illustrate an international standard, is that it maintains a fixed exchange. But the gold standard itself is now employed in more senses than one. It has been argued that the Bank of England might and should fix the price of gold from time to time, that is to say, that Great Britain should maintain the gold standard but with a Mint par of exchange subject to frequent variations. That is not what I mean by the gold standard. If a country is not prepared to adjust internal conditions in such a manner as to preserve the Mint parity as long as is humanly possible, it cannot be said to be on the gold standard. It rejects that discipline which is an essential feature of the system. Nor do I believe that the proposal to maintain a wide margin between the buying and selling price of gold is wholly consistent with the gold standard. For the effect, if not the purpose, of such a margin is to delay the correcting influences that are brought into operation under the gold standard. These so-called modifications may or may not be desirable in themselves; they are, however, alternatives to the system which maintains a fixed exchange; they belong to the category of schemes which aim at internal price stability.

It is far less easy to explain the term "stability" in relation to prices. Clearly it does not mean an unvarying price for every commodity that is sold or service that is rendered in the community. Changes in individual prices are bound to occur under the system of private enterprise. So long as individual choice is allowed, demands are bound to fluctuate, and these fluctuations, combined with technological changes in the conditions of supply, necessarily produce price variation. Stability refers not to individual prices but obviously to an average of prices. What meaning should we attach to the phrase "stability of the price level"? Having defined the phrase we are then faced with the question whether stability in that sense is both possible or practicable and desirable.

There are four kinds of changes possible in the price level. The first represents seasonal changes in demand; the second represents cyclical changes in industry and trade; the third represents long-period changes or changes in the trend of prices, while the fourth may be regarded as irregular changes in prices, that is to say, changes

that are due to the conditions of supply or to real changes in demand. Those who believe that monetary policy should aim at maintaining a stable price level usually seek to eliminate the second type of change and possibly the third. When people refer to the behaviour or misbehaviour of prices they generally refer to their behaviour during the course of a trade cycle. They argue that currency should be so managed as to eliminate the trade cycle or as far as possible to reduce the amplitude of cyclical fluctuations. Some would welcome a slight upward trend in prices on the ground that it would gradually change the distribution of the national income in a manner favourable to the active workers in the community without producing an appreciable injury to the rate of accumulation of capital. No advocate of currency management appears to attach any importance to seasonal changes in the price level. The fourth type of change, that is to say, change due to factors internal to the industry supplying a given commodity, will call for consideration presently.

For the purpose of the present discussion it is necessary to make three main assumptions. The first is that by a stable price level is meant an unvarying price level. The second is that in an isolated community it is possible to pursue a monetary policy which will, in fact, maintain such a price level. The third assumption is that the maintenance of such a price level is not merely possible but also desirable. I am fully aware of the fact that each of these assumptions can be and will be challenged. I would myself venture to challenge each of them in other circumstances. Nevertheless, unless such assumptions are made, there can be no discussion of the subject of my paper.

A. The first assumption might be challenged both by advocates of currency management and by its opponents. The former might say that my interpretation of stability is far too rigid and that what is really meant is the absence of such fluctuations in the price level as might in turn prove to be a disturbing influence upon the course of industry and trade. My reply to that criticism would be that, if we are to make any progress in the discussion of the present subject, a definition of some sort is essential. The suggested alternative raises many questions that are themselves the subject of controversy; some, indeed, are also raised by the other assumptions that I have specified. Again, those who oppose the policy of currency management might argue that if the credit policy of a banking system is to be employed to preserve a stable price level, it can only proceed by correcting price deviations due to other factors. That being so, the credit instrument would not maintain an unvarying price level but would merely act as a correcting influence. Even

if we admit the power of the instrument to influence prices at all times and under all conditions the result would be shown, not in a uniform price level, but in a price level showing regular and very frequent fluctuations around a horizontal or other selected line of trend. A chart representing the course of the price level would be like the edge of a saw. To preserve is not the same thing as to restore what we have failed to preserve. A credit instrument would be like a sheep-dog always trying to keep rebellious sheep in the middle of a wide road—and a sheep-dog which itself was not very expert at the job.

The comment that I have submitted upon the first assumption is not my own. I believe that the difference, in practice, between the operation of the gold standard and the operation of a system of credit control (in an isolated community) has been exaggerated by the advocates of the latter. Under the gold standard the rate of discount and the volume of credit would ultimately be determined by the gold reserve, which we may assume to be constant. During a period of depression there would be a considerable reserve of idle currency; in spite of a low rate of discount the demand for credit would be below the available supply. The recovery of trade would be accompanied by an increasing demand for currency and credit and a rise in the price level; the Bank Rate would be raised by easy stages without exercising a seriously restrictive influence upon trade. At that stage of the trade cycle which is characterized by an appreciable rise in the price level without a corresponding increase in employment (the volume of unemployment having already been reduced to the practicable minimum), a speculative boom would develop; at that stage, too, the Bank Rate would be substantially raised, the purpose of the rise being to prevent speculation from exceeding the limit of prudence.

Under the system of credit control it is extremely unlikely that the central bank would act so boldly and quickly as under the gold standard. So long as unemployment remained the Bank Rate would obviously not be raised. As under the gold system, the price level would slowly rise before normal trade conditions had been reached, but this rise would obviously not call for a change in discount policy. Such a change would become desirable at the point at which profit inflation was beginning to appear and speculation was casting its shadow. At that stage, if the Bank desired to make its policy really effective, the rise in Bank Rate would need to be appreciable and probably accompanied by the sale of securities. Such a policy, however, would be by no means welcome. The business community, as always, would be in favour of delay. Nor is it likely that the Government would welcome the Bank's action.

During a period of rising prices public expenditure would always lag behind price changes. A rising price level would mean easy and popular budgets; a strong central bank policy would mean difficult and unpopular budgets. It seems to me, therefore, that a strong central bank would always be unpopular. It would inevitably fall under the influence of the Government, particularly a weak Government, which would always be able to supply legal tender. I believe that the system of credit control, in such a community, would mean, in practice, periods of inflation invariably followed by stabilization crises and severe depressions of trade. I cannot help feeling, therefore, that in an isolated community a greater measure of what is called stability in prices and in general economic conditions would be likely to be achieved, in practice, under the gold standard than under the proposed system of credit control. But it is not necessary, for the purpose of the present discussion, to assume that my view is correct. We are concerned in the present discussion, not with an isolated community, but with a group of communities politically independent of each other but economically inter-dependent.

B. Before submitting any comments upon the assumption that it is possible, in practice, to maintain a stable price level, I should like to pass on to consider the third assumption, namely, that such a policy is desirable. It is, of course, obvious that the question of desirability only arises in relation to things that are possible. I have stated the assumptions in logical order and I depart from that order merely because, for the purpose of the present discussion, it is convenient to do so. The assumption that it is desirable to pursue a policy designed to maintain stability in the price level may be challenged on two grounds. It will be admitted that price stability is not an end in itself. The purpose of production is to provide an income of goods and services. That economic system which guarantees or offers a prospect of the maximum rate of social progress is to be preferred to other systems. A condition of such progress is the maintenance of what may broadly be called economic stability. By economic stability I mean such an adjustment of the parts of the economic system to each other as will secure the maximum individual and collective contribution. Such stability includes what is commonly called a proper balance of production. Now all these are question-begging terms and phrases, but I cannot state more precisely those things which are taken for granted in all discussions of economic affairs. They will be accepted as readily by those who advocate what is commonly called a managed currency as by those who believe that social progress is facilitated by the employment of an international standard which will maintain fixed

exchanges. The former believe that a stable price level will both maintain and reflect a stable industrial system and promote industrial and social progress to an extent that is impossible under the alternative system.

(1) The assumption with which we are now concerned may be challenged, first, on the ground that a stable price level, so far from revealing industrial stability or equilibrium, may actually hide industrial disequilibrium and therefore obstruct those correcting influences by which equilibrium might otherwise have been restored. This criticism is well known to all members of the audience; it has repeatedly been made by Austrian economists and their followers in this country. Supporting evidence has been drawn from the history of the United States of America during the period of prosperity preceding the present depression. Technological changes in American industry were so rapid and important as to reduce to an appreciable extent the real costs of production. During the same period the monetary policy of the American banking system was such as to maintain a price level which did not fall at the same rate as the real costs of production. The consequent relative increase in the supply of currency and credit constituted a type of inflation which resulted in a speculative boom followed by the inevitable crash.

This criticism may itself evoke three replies. (a) It may be argued that what the critics show is not that a policy of credit control would be undesirable if it were successful, but that in the case of America, and on the assumption that the Federal Reserve system actually endeavoured to maintain a stable price level, a policy of maintaining price stability did not, in fact, prevent cyclical fluctuations in industry and trade. Further, since cyclical fluctuations are not removed, the policy of maintaining a stable price level cannot be permanently successful. It might even be held that such price stability as was associated with the policy was of a kind that would have been maintained even under the orthodox system characteristic of the pre-war period. In other words, there is at least one phase of the trade cycle during which the price level is in any case comparatively stable. It might therefore be argued that the policy of credit control in the United States enjoyed the appearance of success during that period within which there would in any case have been a considerable measure of stability in the price level. It will be observed that this reply also constitutes a challenge to the second assumption, namely, that it is possible in practice to maintain a stable price level by means of credit control.

(b) The second reply that may be given to the Austrian criticism is that such criticism, in so far as it is based upon a true interpretation

of American history, shows, not that credit control in general is undesirable, but that the particular policy that was employed in the United States did not meet the requirements of that country. If the policy had been such as to produce a gradual fall in the price level parallel to the fall in the level of real costs of production, profit inflation would have been impossible, the speculative boom would not have developed and the United States would have escaped the subsequent and consequent depression in industry. Credit policy should be so framed as to secure a movement in the price level parallel to the movement in the level of real costs of production. It will be observed that this reply arises from the rejection of the view that credit control should aim at an unvarying price level. But I believe that I am right in saying that Mr. Keynes would reject such an interpretation of the theory of credit control. He would favour a policy aiming at an unvarying level of wholesale prices, which would involve a gradual rise in retail prices and in the rate of remuneration for personal services. In other words, he would favour a gradual rise in the general price level, the purpose being gradually to reduce the burden of capital charges incurred in the more or less distant past. That being so, the Austrian criticism, in so far as it is based upon a correct interpretation of American history, is relevant and strong.

(c) The third reply to the Austrian criticism is that it is based upon an erroneous interpretation of recent American history. It may be stated that, in spite of the published declarations of the Federal Reserve Board and of responsible individuals, the actual policy of the banking system during the period of trade prosperity did not represent an attempt to maintain a stable price level in the sense in which the words are used by the advocates of a managed currency. Although not based upon gold reserves, the actual policy of the banking system was in other respects much more orthodox than it is assumed to have been.

(2) I now proceed to consider the second challenge to or criticism of the third main assumption that I have made, namely, the assumption that a policy of credit control which seeks to maintain a stable price level is not only practicable but also desirable. It is not suggested in this criticism that it is impossible to maintain a stable price level through credit control. Nor is it suggested that a stable price level, if maintained, necessarily or even probably reveals or creates industrial disequilibrium. It assumes a stable price level and it also assumes that industrial stability is maintained. But it denies that the type of industrial stability that is maintained under such a system is the one that produces the highest rate of industrial and social progress. Nothing is more unnatural than a perfectly

straight line; nothing more difficult to maintain than a uniform rate of movement. Rhythm in all forms of life is not merely natural but also, in most cases, desirable. Competitors in a hundred yards race seek to reach their goal in the shortest possible time; they do not pause to consider whether they are running in a straight line or even at a constant speed, and if the course that they have actually taken is examined, it is found that they do not actually move in a straight line. Similarly it may be argued that if industry were compelled to move in a straight line it would not fulfil its purpose so surely and so speedily as would otherwise be the case. For this reason policy ought to be such as to prevent exaggerated or excessive fluctuations in industry and trade while allowing those which constitute the rhythm of life and activity to continue. In so far as it was successful a policy of credit control, by removing all fluctuations of a general character, would actually restrict industrial development and retard social progress. The corrective working within the industrial system and operating upon and through individual industries are likely to be more effective in maintaining a true industrial balance and promoting economic progress than a corrective introduced through the credit system and operating upon the whole of industry and trade at the same time, irrespective of the condition of individual trades.

C. I now return to the second of the three fundamental assumptions that I have made, namely, that it is possible in practice to maintain a stable price level. In considering this assumption I take it for granted, first, that it is the final purpose of the stable price policy to maintain industrial equilibrium and, second, that if a stable price policy is successfully pursued, it either maintains or restores such industrial equilibrium. I am now concerned with the assumption that a stable price policy is one that can be pursued with success. This assumption may be challenged on the ground that what I have called an irregular change in prices, that is to say, a change in prices due to non-monetary factors, cannot be controlled or rectified by credit control. Among eminent economists it is Mr. Hawtrey who seems to hold the strongest belief in the power to stimulate industry by appropriate measures in the sphere of credit. But he agrees that individual industries may fall so far out of line with the remainder as to make it impossible for them to be brought back by a credit policy of a general character. He seems to hold the view, however, that the persistent post-war depression in British industry during a period when America and other parts of the world were enjoying prosperity was due to the over-valuation of sterling and the consequent restriction of credit in this country. He expresses the belief that if an appropriate credit policy had been

pursued we might have enjoyed a far greater measure of prosperity than was actually the case and that the depression of the basic industries would have been overcome.

As one who lives in the north I am fully conscious of the depressing effect upon the chief exporting industries of this country produced by the over-valuation of sterling, but I find myself unable to accept Mr. Hawtrey's conclusion. I am concerned, however, less with the facts than with possibilities. Let us assume that the policy of economic nationalism is pursued even more vigorously than in the past; that the Indian and Japanese cotton industries grow more rapidly in the future than they have done during the last fifteen years; and that lignite, electricity and oil are substituted for coal on a far larger scale than has hitherto been the case. Obviously the depression in the north of England would be intensified. Can it be said that a system of credit control, in the sense in which the words are employed in this paper, would restore prosperity in the depressed areas of this country?

During the post-war period for which the gold standard was in operation Great Britain could be regarded as comprising two distinct economic areas, the depressed north (including South Wales) and the more or less prosperous south. The credit policy which, along with currency over-valuation, is said to have intensified the depression of the north, actually maintained prosperity in the south. Presumably, therefore, two distinct credit policies were required, one for the south and a much easier credit policy for the north. Even if the pound had been correctly valued in relation to gold and a policy of easy credit had been maintained in the north of Great Britain, I do not believe that it would have been sufficient to restore prosperity. There would still be redundant shipyards, superfluous coal-mines, and surplus cotton factories. A policy of easy credit could only have restored prosperity to the north by stimulating the growth of entirely new industries, but even in such a case I do not believe that the difference between the price of credit in the north and in the south, under a differential system, would have materially influenced the trend of industrial development during the last ten years. Those industries that have flocked to the south would not have been attracted to the north. In order to attract new industries quickly to the north it would have been necessary to build a tariff wall around that part of the country. I shall return to this point presently; for the present I am merely concerned to point out that the assumption that I have made in this paper is one that is open to challenge. The price level that is stabilized by means of credit control is an average of a selected group of individual prices; the prices of a number of individual commodities may be seriously

influenced by irregular or internal factors; variation in such prices would influence the price level that is controlled, and in order to maintain a stable price level it would be necessary to pursue a credit policy that would involve a rise, possibly a substantial rise, in the prices of those commodities that have not been influenced by irregular or internal factors. Nor is it necessary to assume that the disturbing or irregular influences upon individual prices are international influences; the changes may be due to technological changes in production or to a real change in the demand for the commodities.

It is true that such changes do not reduce the amount of purchasing power available in the community, for which reason it is sometimes held (I believe, indeed, that Mr. Hawtrey would hold) that the internal changes in individual industries would result in an increase in the demand for other commodities, with the result that general industrial equilibrium would gradually be restored with a changed relationship in individual prices. That statement, however, does not dispose of the contention that industrial changes due to non-monetary influences may be so serious as to cause a general depression of trade, and that such a depression will not readily respond to monetary treatment.

I have said enough to show that I do not regard as unchallengeable the three main assumptions upon which the remainder of the discussion will be based. Nevertheless, they are necessary assumptions if we are to proceed with a discussion of the two alternatives that are indicated in the title of my address. If it is impossible or undesirable to maintain a stable price system in an isolated community, there is not much to be gained by a discussion of the two alternatives available to a community which forms part of a larger community. I venture to add two other observations. In the first place, I do not believe that there is anything to be gained from a study of statistical data. In the second place, since we are concerned with long-term considerations relating to policies working under normal conditions, we should not rush to conclusions based upon post-war experience. Since the war there have been periods of stable price levels under paper currencies both in this and in other countries. But they were periods of industrial depression and relatively low Bank Rates; a depression price level is usually a stable price level irrespective of the currency standard, while a low Bank Rate, which merely represents a depression price level for money, is only effective (if at all) as a stimulus after a long period of operation. There is nothing in statistical data to suggest that a low price for money is more effective than a low price for coal or cotton or any other commodity as a stimulus to trade in com-

modities. In so far as it may be said to have a special influence which is not shared by the cheapness of other commodities, it is more likely to be exercised in the sphere of investment than in any other sphere of economic activity. But I cannot find any statistical data that shows, beyond challenge, the influence of the low price of credit either upon the demand for credit or upon the demand for investment capital.

Nor is it wise to attach much importance to the post-war experience either of the gold standard or of so-called currency management. The post-war gold standard has proved unworkable because the gold standard countries have not accepted the implications of an international standard, with its fixed exchanges. The alternative system, which was in operation before the gold standard was restored and was again brought into operation when the gold standard was suspended, should not be assumed to represent the type of currency and credit control that would be exercised under a proper system designed to maintain internal price stability. A world dominated by fear is not a world in which any currency system can hope to operate with success; an economic system liable to be upset by panic movements of funds cannot be effectively controlled by any monetary system. The world is fit neither for the gold standard nor for a managed currency system. For some time to come nations will need to improvise methods of meeting rapidly changing conditions. The organization of a real and permanent monetary system must be left for the future, when the world truly believes in peace and nations are prepared to deal rationally with each other.

II

It is always easier to criticize than to justify a system that is actually in operation; the defects and failures of the system are obvious, but its achievements, as distinguished from the possible achievements of an alternative, cannot be measured. It is easier to advocate a new and untried system than to criticize it; being new it is given merely in general outline, the details being left to be supplied later. Those who advocate national currency systems seem at one time to attack the gold standard on the ground that it does not work well, at another time on the ground that it works too well. At one time they appear to be concerned with the practical defects of the post-war gold standard, at another time they seem to find fault with the principle of the gold standard. When they advocate national currency systems they seem to justify their proposal at one time on the ground that it is impossible to secure that unity of international control that is essential to the pursuit of

a common credit policy, and at another time on the ground that the economic conditions vary so much between different countries as to necessitate different credit conditions at one and the same time. Being a Welshman I sometimes ask myself whether they would prefer to establish separate central banks for England and Wales, or whether they desire the Bank of England to control credit policy for the whole of this island. I have never actually met anyone who wished to establish Home Rule in finance for Wales. Nor have I seen it suggested that each of the separate states of the United States of America should establish a central bank of its own, nor indeed that any of the existing Federal Reserve banks should act independently of the remainder.

You will already have seen what I am driving at. Let us assume that an international central bank is created and is able to impose its will upon all the national central banks in the world so that the same monetary policy is pursued in all countries at the same time. The question arises whether such a system would be preferred to a managed currency system by those who now advocate the latter, that is to say, whether their advocacy of credit control is due to the difficulty, even impossibility, of securing international control of credit policy. Such is not necessarily the case. Advocates of independent national currencies may feel that different countries require different credit policies at one and the same time, that is to say, that the significant differences between countries are economic rather than political. The following quotation from Mr. Keynes' *Treatise on Money* (Vol. II, p. 326) illustrates this view. That it is drawn from a section advocating a relatively wide margin between the buying and selling prices of gold is of no significance in this connection. "In the autumn of 1928 local conditions in the United States convinced the Federal Reserve Board that the short-period interest-rate should be raised in the interests of business stability; but local conditions in Great Britain were of a precisely opposite character, and the Bank of England was anxious to keep money as cheap as possible. The Federal Reserve Board did not desire that its high rates should attract gold from Great Britain; for this, if it occurred, would have tended to defeat its efforts. Nor did the Bank of England desire to impose high rates in Great Britain—to which it might be driven—in order to prevent its gold from flowing out." It is clear that the point emphasized by Mr. Keynes is that the difference between the economic conditions of the two countries called for a corresponding difference in credit policy.

I return to the illustration drawn from the recent history of our own country, and ask the question whether the advocates of a managed currency would have pursued two different credit policies

in the north and south of this country. The situation in the south resembled that prevailing in the greater part of the United States rather than that in the north of England; the situation in the north resembled that prevailing in parts of the New England States more closely than it resembled the situation in the south of England. If they would not have differentiated, would the credit policy have been governed by the economic conditions prevailing in the south of England or by those prevailing in the north of England? For the purpose of credit control, would they have based the Bank Rate upon the prices of wholesale commodities obtained very largely from abroad, upon retail prices, which differ very little between north and south, or upon the wholesale prices of commodities produced respectively in the north and south of this island? It seems to me that this question goes to the very root of the discussion. If this island is to be regarded as a unit, why not Belgium and Holland, or Holland and Germany, or Germany and France?

In this connection it is interesting to note that, in spite of the argument in the passage already quoted, Mr. Keynes seems to regard an international system as the ideal towards which we should aim. On pp. 337 and 338 of the same volume he sums up his views as follows:—"On a balance of these various considerations, it seemed, before the *de facto* return to the gold standard, that there were better prospects for the management of a national currency on progressive lines if it were to be freed from the inconvenient and sometimes dangerous obligation of being tied to an unmanaged international system; that the evolution of independent national systems with fluctuating exchange rates would be the next step to work for; and that the linking up of these again into a managed international system would probably come as the last stage of all." But as he seems to include in such a system a discretion, on the part of each national monetary system, "to vary the value of its local money in terms of gold within a range of (say) 2 per cent.," he cannot be accused of inconsistency.

The difficulty to which Mr. Keynes refers in the first paragraph already quoted is described in more general terms in other parts of the same volume, but it is not the only difficulty inherent either in the gold standard, as such, or in the gold standard as it actually operated after the post-war restoration. I submit the following quotations as a summary of the types of criticism to which the gold standard has been subjected.

(a) "Circumstances may exist in which, if a country's rate of interest is fixed for it by outside circumstances, it is impracticable for it to reach investment equilibrium at home. This will happen if its foreign balance is inelastic, and if, at the same time, it is

unable to absorb the whole of its savings in new investment at the world rate of interest. It will also tend to happen even where the foreign balance is elastic, if its money costs of production are sticky. There are, moreover, all sorts of other reasons why the day-to-day preservation of local investment equilibrium may require some departure of the local rate of interest from the international rate.

“ This, then, is the dilemma of an international monetary system—to preserve the advantages of the local currencies of the various members of the system in terms of the international standard, and to preserve at the same time an adequate local autonomy for each member over its domestic rate of interest and its volume of foreign lending ” (pp. 303–4).

(b) “ The possible range, between the terms on which one currency can be exchanged for another and the terms on which the exchange can be reversed at a later date, is determined by what is called . . . the distance between the gold points. The greater the distance between the gold points, the less sensitive to short-period external changes a country’s rate of foreign lending will be ” (p. 320).

(c) “ What, then, is the reason for hesitating before we commit ourselves to such a system? Primarily a doubt whether it is wise to have a Currency System with a much wider ambit than our Banking System, our Tariff System and our Wage System. Can we afford to allow a disproportionate degree of mobility to a single element in an economic system which we leave extremely rigid in several other respects? If there was the same mobility internationally in all other respects as there is nationally, it might be a different matter. But to introduce a mobile element, highly sensitive to outside influences, as a connected part of a machine of which the other parts are much more rigid, may invite breakages ” (pp. 334–5).

(d) “ A change in international financial conditions or in the wind and weather of speculative investment may alter the volume of foreign lending, if nothing is done to counteract it, by tens of millions in a few weeks. Yet there is no possibility of rapidly altering the balance of imports and exports to correspond.

“ Nor are short-period considerations of this character the only ground for hesitation before plunging for an international standard. The monetary development of different countries is at many different stages; and the education of the public in monetary principles is also along differing lines. I should say, for example, that the present attitude towards gold on the part of the Bank of England or of the Reichsbank is fundamentally different from that of the

Bank of France or the Bank of Spain, and that changes for which the former may be ripe in the course of the next five years or ten years might still prove too novel for the latter" (p. 336).

It will be observed that Mr. Keynes stresses the rigidity of the industrial system, the inelasticity of the foreign balance and the mobility of capital, in the form both of long-term investments and of short-term loans or even funds retained as deposits. The mobility of capital, under the gold standard, may prevent a country from maintaining that rate of interest which will establish and preserve a balance between saving and investment. Elsewhere in the same volume he states, in effect, that the gold standard has made the trade cycle an international phenomenon. Incidentally it may be pointed out that in so far as this statement is true, that is to say, that in so far as depressions, for example, tend to be international, the relation between saving and investment will be of the same order in all countries, so that in practice it is extremely unlikely that the contingency that is feared will happen, the contingency being that while a balance between saving and investment in one country is conditioned by a low rate of interest, in another it can be maintained at a high rate while importing capital from the first. The circumstances of 1928, to which reference was made in the first quotation from Mr. Keynes' book, were peculiar in the sense that this country was suffering from a persistent depression due partly to the redirection of world trade and partly to the over-valuation of sterling. The gold standard, as such, cannot be blamed for this difficulty.

Nevertheless, it will be agreed that the difficulties to which Mr. Keynes refers are real and may prove serious unless appropriate safeguards are adopted. And they tend to increase with the increase in the number of securities that are quickly realizable and make an international appeal to investors. The first point that I venture to submit is that they are not removed, or even reduced, but merely changed in character by the adoption of national monetary systems. Further, it is not the gold standard that converts the trade cycle into an international phenomenon but the existence of international trade in commodities.

Let us suppose that the world consists of two countries, one large (France) and the other small (Great Britain), and that while France is prosperous and maintains an interest rate of 5 per cent., Great Britain is suffering from depression and is in need of a 2 per cent. rate. Let us further suppose that the two countries are on paper standards, each seeking internal price stability. Clearly it will be possible for Great Britain to establish and, for a time, to maintain a rate of 2 per cent. Under such conditions, however,

there will be a movement of capital from Great Britain to France, and that will continue until the depreciation of sterling exchange neutralizes the effect of the difference in the rate of interest. The gap in Great Britain will be filled by an expansion of credit. If we assume that 2 per cent. establishes the desired balance between saving and investment, that is to say, that trade is stimulated, a further stimulus will be provided by that degree of external depreciation created by the movement of funds to France.* The consequent rise in sterling prices will reduce purchasing power parity to the level, say, of the actual rate of exchange, so that when the funds return to Great Britain, they will actually be converted into a larger amount of sterling than that which was exported. Most of the investors in francs have not merely earned a higher rate of interest, but also partly or wholly escaped the loss of purchasing power due to the rise in the sterling price level. Moreover, instead of having invested at 2 per cent. and thereby suffered loss through capital depreciation, they are now able to invest the larger amount in securities yielding a higher net rate of interest. At the point of so-called stabilization the incoming funds will cause savings once more to exceed investment; moreover, the rates of exchange will move strongly in favour of sterling, which will thus be overvalued. The forces making for depression will once more reign supreme.

This illustration seems to me to show that when differential rates of interest prevail, capital movements will take place irrespective of the character of the monetary systems. They tend to be on an even greater scale under a system of national currencies than under the gold standard. For, under the former, an additional inducement to transfer capital is supplied by the opportunity of making substantial profits on exchange fluctuations. Post-war history supplies many illustrations of my statement, not the least important being the transfer of American funds to London during the months preceding the restoration of the gold standard. I do not desire, however, to stress the importance of such illustrations, for in no country was the policy of the monetary authorities directed towards maintaining internal price stability and at the same time pursued under conditions that offered a fair test of such a policy.

The general statement that I venture to submit is that the existence of differential rates of interest—the difference being justified by differences in the internal conditions of the two countries—will cause a transfer of capital from one country to the other; that such transfer will disturb the exchange relationships between

* If the assumption is not true it is also unlikely that external depreciation will provide a progressive stimulus to trade.

the two countries; that such disturbance will strengthen the movement of capital by introducing a new form of possible gain, and that the net result will be to destroy the possibility of maintaining internal price stability or a uniform rate of industrial progress.

In my comment upon Mr. Keynes' statements I have assumed two countries to be maintaining two different rates of interest under the conditions indicated by Mr. Keynes—one country being depressed and the other relatively prosperous. But I do not believe that Mr. Keynes has done full justice to the system for which he has shown sympathy. The task of the national currency system, in the depressed country, is to restore equilibrium—to raise prices rather than to maintain stability in a price level which is characteristic of a state of equilibrium. Two completely isolated countries may, however, maintain states of economic equilibrium at different rates of interest. And these provide the test case. If they enter into trade relations with each other there can only be one equilibrium rate of pure interest whether they adopt an international currency standard or retain independent currency systems. And the process of adjustment to the new rate is one of disturbance or disorganization. It seems to me, therefore, that my comment upon Mr. Keynes' statements is not limited to the assumption implied in those statements; it states a truth of general application.

Capital movements, although important as an item in the "balance of payments," is not the only important item. It is necessary, at this stage, to draw attention to the remaining items. Let us assume that Great Britain adopts a policy of "credit control" while the rest of the world maintains the gold standard, and that the gold price level shows a steady upward trend while we endeavour to maintain a stable price level. It is obvious that unless purchasing power parity is adjusted to the new conditions as the latter come into being, our price level will be affected. But such an adjustment is no more than a theoretical possibility. It is clear that in practice exports will increase and imports diminish. The sterling price level will rise in sympathy with the rise in the gold price level. Presumably the Bank Rate will be raised sufficiently to reduce prices to the old level. In any case the country will be on the horns of a dilemma. It may either accept the rise in the price level and abandon the idea of internal price stability in favour of exchange stability, or cling to its declared policy, force a "stabilization crisis" and accept, as the price of its policy, an intermediate period of adjustment during which industry will suffer from instability and depression. This case is ignored by advocates of national currency systems, who invariably concentrate attention upon the case in which the gold price level is on a downward trend.

Even in this case, however, there will be an intermediate period during which the external price level would influence internal conditions, with the result that "credit control" would merely mean an attempt to restore an equilibrium that had already been disturbed, rather than to maintain an unbroken equilibrium. The whole theory of credit control rests upon two assumptions, each of which is false. The first is that a change in the price average (or price level) takes place without a change in the relative prices of the items entering into that average, and the second is that the actual rate of exchange can be adjusted to a changing purchasing power parity (as determined by relative price levels) at the precise moment of every change in that parity. Neither of these assumptions is within reach of the probable in economic affairs. And if they are not realized in practice the resulting disequilibrium is the more serious in that it brings no real corrective into operation.

Nor is that the only objection to the theory of credit control. It seems to me to fail to distinguish between a variation in demand which accompanies a change in price and a real change in demand. Depression and a falling gold price level in the world outside results in a real fall in the demand for our products, so that even if the two specified assumptions were true, we should still suffer from that depression. Our exports would diminish. That loss of trade would cause a fall in the demand for products of the type imported; even if actual imports did not diminish, the demand for competing products produced at home would be reduced. Our industries and trade would suffer from causes outside our control and therefore (regarding ourselves as an independent, "insulated" community) from a "non-monetary" cause.

This brings me to the next difficulty in accepting the theory of credit control. So long as the depression continued in the world outside Great Britain, the restoration of purchasing power parity would not solve our difficulties. The demand for our products would continue to be less than under normal conditions. But it would be easy for us to reduce the relative prices of our exports by reducing the external value of our currency below that representing purchasing power parity. Moreover, during a period of depression, when work seems to be more important than its results, the temptation to do so would be strong. For the immediate effect of such a reduction would be to increase our exports at the expense of competing industries in other countries and to restrict our imports, to the advantage of competing industries in this country.* It is

* I do not suggest that an increase in the physical volume of trade due to external depreciation of currency necessarily represents an advantage to the country that depreciates its currency. The precise effects will be determined

therefore not an exaggeration to state that one inevitable result of the pursuit of internal price stability and the sacrifice of exchange stability would be the deliberate use of currency depreciation as a method of preventing price instability or restoring stability. But no country would enjoy a monopoly of the use of that weapon. Competitive currency depreciation, now so popular, is not the product of a crisis but the product of those conditions that would always tend to appear in a world lacking an international standard of value. For, by assumption, every country would pursue a nationalist policy, uninfluenced by any form of international discipline. By reducing the external value of its currency below the purchasing power parity each country would be reducing, in effect, its internal competitive costs and wages, or, stated otherwise, imposing restrictive tariffs upon imports and subsidizing exports. Controlled depreciation would become as popular as controlled inflation, but, whereas the latter is possible for all countries at the same time, the former cannot be universally employed. Presumed benefit to one is real injury to another—nor is it necessary to my purpose to indicate which is injured and which benefited, or whether any really enjoys a benefit. It is sufficient to suggest that the present exchange policy of the United States of America is an integral part of the wider policy of maintaining a stable “commodity” dollar. The policy to which I refer is that of deliberately reducing the external value of the dollar below purchasing power parity in the hope that it will stimulate expansion of currency and credit and a consequent increase in trade and a rise in the dollar price level.

I now return to Mr. Keynes' reference to the mobility of capital, the inelasticity of the foreign balance and the rigidity of internal costs. Two related but separate difficulties are created by these features of the modern economic system. The first, we are told, is that of maintaining a rate of interest which establishes and maintains a balance between saving and investment. I have already considered this difficulty and suggested that it is not solved by maintaining an independent currency system. The second difficulty is that of maintaining the gold standard or any other system

by the relative elasticities of demands for exports and imports. If both groups of demands are highly elastic a slight external depreciation may secure a net advantage, but if they are highly inelastic, the result may be a serious loss. In the latter case, too, external depreciation may increase rather than reduce the difficulty of restoring a balance of payments or convert a pre-existing export surplus into an import surplus. In any event the maintenance of a depreciated currency increases the real costs of providing a national income of given amount. But we are here concerned with probable human action, not with pure theory. A world that believes in protection as a method of increasing national income will also believe that currency depreciation, by stimulating particular forms of activity, will increase the national income.

which maintains fixed exchanges. It is held that a gold standard which is bound to collapse at frequent intervals differs from the pre-war gold standard. The change in the world economic system has made the latter impossible; the former suffers from weaknesses peculiar to itself. Comparison should be made not between a national currency system and the pre-war gold standard, but between the former and that type of gold standard which is possible under modern conditions. This argument seems to me relevant and important, for it will be generally agreed that the conditions under which the pre-war currency system operated cannot be restored.

The interpretation of post-war history which is submitted by Mr. Keynes thus becomes a subject of the first importance. The circumstances under which the major movements of capital took place first call for comment. There was a flight from the German mark during the period of instability preceding the occupation of the Ruhr, and a flight from the French franc during the period ending in 1926, when that currency was stabilized in terms of gold, followed by a further export of French funds until the gold standard was restored by legislation. In both cases the frightened owners sought security by transferring their funds mainly to gold standard countries. The third great transfer was that of American funds to London during the period of stability preceding the restoration of the gold standard, and the fourth was the transfer of funds to America during the last speculative boom.

In the first two cases the gold standard countries were the *recipients* of funds; in the third, the country with an appreciating currency attracted funds seeking a profit on exchange as well as a higher rate of interest. In none of these cases would such a transfer have been likely to occur if all four countries had been on the gold standard throughout the period under consideration. Large-scale movements were the product both of political and economic instability and of that kind of uncertainty which is inevitable under national currency systems. In the fourth case funds left one gold standard country for another in search of gains through speculation. I return to this case below.

The flight from sterling that led to the suspension of specie payment in September, 1931, was due to the fear on the part of foreign investors that we should not be able to maintain the gold standard. Fear created its own justification. If everybody had believed the standard to be safe and permanent there would have been no outward large-scale flow of capital. Confidence would then have created its own justification. This brings me to my second comment upon Mr. Keynes' interpretation of recent history. When

we returned to the gold standard sterling was seriously overvalued, with the result that our export balance diminished. We invested capital abroad—in long-term securities—on a scale beyond that permitted by such balance. In the absence of the large inflow of foreign funds, to which I have already referred, we should either have been driven off the gold standard much sooner or have reduced the annual flow of foreign investment. It is impossible to state which of the two results would have followed. But I suggest the following as, in my view, a reasonable interpretation of the situation. It is known that European investors fought shy of long-term securities; they were too nervous to resume pre-war practice. Meanwhile the world needed capital for economic development, and obtained it from London, the London market, in turn, obtaining the balance over internal supplies by utilizing foreign funds sent there for security. My view is that if foreign investors had been equally courageous, instead of sending funds to London they would have competed for the investments offered by other countries and our foreign investments would have been correspondingly reduced. If I am right it follows not only that our policy facilitated world progress but also that foreign investment was related to the reverse movement of funds. If, on account of the reduction in our export balance, we had severely restricted the export of capital, interest rates would have risen to a higher level in borrowing countries; they might even have reached a sufficiently high level to attract those funds that were actually sent to this country. It is, of course, true that our policy, while facilitating progress elsewhere, endangered the stability of sterling and ultimately drove us off the gold standard; nevertheless, it remains true that so long as the gold standard seemed safe, the movements of short-dated funds were complementary to foreign investment and were of such amount as to preserve a balance of payments. It seems to me, therefore, that Mr. Keynes exaggerates the difficulty created by the apparent failure of the export balance to adjust itself to the flow of foreign investment. If the crisis of 1931 had not occurred, foreign funds held in London would have been employed in due course in the purchase of the foreign securities issued in London and financed with the aid of such funds. Again, if, during the same period, we had not been on the gold standard, we would not have escaped difficulties. If, for the purpose of stimulating trade, we had maintained a low rate of interest, our foreign investments would have been on a larger scale than was actually the case. So long as our price level remained relatively constant we might still have received funds from abroad; but as soon as a debit balance appeared the value of sterling would have fallen heavily. This fall, in turn,

would have resulted in a panic flight from sterling followed either by rapid inflation or by a high rate of discount and severe reduction in trade and employment. The gold standard or, in its absence, the effort to maintain exchange stability acts as the great centripetal force in the economic system.

Nor do I believe that the so-called rigidity of costs has proved to be so serious a factor as we are frequently asked to believe. I need not discuss this subject in detail. I shall merely submit two statements. In the first place, fixed charges are not an element in those current costs by which prices are determined. They constitute a real burden upon industry at present, but they do not affect the elasticity of prices. In the second place, wages were far from rigid. They were sufficiently elastic to meet the requirements of the gold standard as such, though not to meet the combined needs of a falling gold price level and an overvalued sterling. The gold standard as a system has been blamed for the evils of currency over-valuation.

It seems to me, therefore, that the difficulties of maintaining the gold standard in future have been over-emphasized by Mr. Keynes. The gold standard has been blamed for events and conditions really due to deeper causes, which would have produced equally serious disturbances under national currency systems. I have already agreed, however, that the difficulties indicated by Mr. Keynes are important. Nor would it be wise on our part to restore the gold standard until they can be met. It is not part of my task to indicate the conditions and terms of restoration, for I am concerned with the relative merits of two alternative systems working under objective conditions that suggest order rather than chaos. But I venture to suggest that so long as the danger exists of a rapid movement of funds from one country to another, either for speculative purposes or for political reasons, an international exchange control fund will be necessary. Such a fund, administered by the International Bank of Economic Settlements, would form a substitute for the fund employed, before the war, by the Bank of England in the interests of stability in all countries that were threatened by forces beyond their control.

In the discussion of the relative merits of an international standard and a national currency system seeking internal price stability, I further assume that the gold standard is managed with care and efficiency by people who are aware of its problems and are anxious to use it as an instrument of economic progress; in other words, I assume willingness on the part of Governments to co-operate in the attempt to maintain industrial stability and to accept the assumptions of such co-operation. Given such con-

ditions (which include control of speculation by appropriate central bank policy) and the existence of an international exchange control fund, the conditions prevailing in the United States in 1928 (described by Mr. Keynes in one of the paragraphs already quoted) and their effects upon our own country would not be repeated. In short, the failure of the post-war gold standard was due not to new and permanent features in the world economic system but to abnormal and temporary circumstances that were the outcome of political difficulties and economic disorganization. Those new features that are likely to be permanent are by no means inconsistent with the gold standard. The abnormal circumstances of recent years would have prevented the efficient working of any system, national or international.

This paper may be described as a criticism of those critics of the gold standard who have advocated national currency systems and the pursuit of internal price stability. I have tried to show that the weaknesses of the gold standard seem to have been exaggerated and that a system of national currencies operating within an economic system of which international trade is an essential feature cannot be expected to maintain internal price stability. My fundamental difficulty in accepting the views of Mr. Keynes and his colleagues is that the system of credit control seems to me to be likely, in the course of its operation under normal conditions, to produce precisely those forms of currency disorganization which are now the product of abnormal conditions and for which the national currency system is offered as a remedy. But I have not attempted to cover old ground by indicating the positive advantages of an international currency standard. It is claimed for such a standard that it promotes international economic stability, that it favours a distribution of trade in accordance with real costs of production and that, by controlling currency, it controls credit more effectively than would be possible under the alternative system. These claims seem to me to be justified. If I did not believe in an international currency standard I should be forced to the conclusion that under existing conditions separate currency systems would be needed for the north and south of England. I should also be forced to advocate Home Rule for Wales in currency affairs.

DISCUSSION ON PROFESSOR JONES'S PAPER

MR. R. G. HAWTREY: It is a great pleasure to me to move this vote of thanks. As usual, the mover of a vote of thanks is put in rather an invidious position. He is delighted to congratulate the reader of the paper on the paper as a work of art, but he is bound to

concentrate upon what he regards as its controversial defects. He has to say, in the spirit of Mark Anthony, "I come to bury Cæsar, not to praise him."

I must say a word or two about the first part of the paper, although this is not intended to be the principal part of the controversy.

In the first place, in regard to the definition of price stability, I believe, not in a mechanical stabilization of the index-number but in a stabilization which makes due allowance for changes in real costs. I will not go into that at length, but I mention it because it is relevant to what the paper says about speculation in the United States in the years leading up to 1929. There was a substantial fall in the price level in that period, but that would not, according to my view of price stability, be inconsistent with the fall not being sufficient. On the other hand, I think there are reasons for believing that the fall was quite sufficient. The extravagant speculation was attributable to the process of adjusting the value of stocks and shares to the enormous change which had occurred during and after the War, and which left the national income of the United States two and a half times as large as before.

With regard to the practicability of stabilizing prices on a paper standard, I think that the paper takes an unduly pessimistic view, suggesting that the public and the Government will be perpetually lying in wait to find a path to inflation by a low bank rate and otherwise. Professor Jones refers to the temptation to inflation from a budget and trade point of view. In practice people do not succumb so easily to this temptation. In the first place, it would be necessary to induce in the public a belief in the technical connection between a low bank rate or a paper currency and good trade. That is a point that is not usually appreciated by the public. I do not think that the public in any country, excepting the United States, are on the whole alive to it at the present moment, and in quiet times under a paper currency, such for example as in pre-war Italy, Spain or South America, there was no real pressure in those countries towards additional inflation. It is a mistake to believe that such pressure exists. There is also the question of the attitude of the Government towards a budget deficit. Governments do not in general favour budget deficits merely because they see their way to finance them, especially by methods universally regarded as unsound. These unsound methods are not due to inflationism, but to some overwhelming cause, such as the expenses of a war, forcing the Government to inflation.

With regard to the desirability of price stabilization, are not the doubts of Professor Jones due to a misunderstanding? If he had taken a somewhat different definition of price stability, I think he would have seen that price stability is not merely consistent with economic equilibrium, but is a necessary condition of economic equilibrium; however, I will not go deeply into that because I think it is from the present point of view a side issue. Professor Jones was quite prepared to take it for granted in the second part of his paper, and in that second part, the first position he takes up is, as I under-

stand it, that the substitution of independent paper currencies for an international gold standard does nothing to prevent the migration of short-term money, seeking temporary investment, from one country to another. That seems to me a complete misconception. Short-term money is very easily checked by a premium on forward exchange. Mr. Keynes has explained the principles of that admirably in his tract on Monetary Reform. The charge for forward exchange will automatically check any movement of short-term money against an inconvertible paper currency, unless there is some definite speculative movement based on the belief that the existing rate of exchange is in some sense artificial and liable to be changed. That occurs not when there is an inconvertible currency fluctuating in a free market, but only when the authorities are pegging the rate of exchange at some level that people do not believe will be continuously maintained. It is a characteristic of a gold standard, and a gold standard which is distrusted. The condition of avoiding that, therefore, is that the gold standard should be trusted.

I said in the beginning that there is much in Professor Jones' paper with which I agree, and I have myself been a consistent and persistent advocate of an international gold standard, but always on the condition that adequate steps are taken, by international co-operation or otherwise, to secure that undue fluctuations in the purchasing power of gold do not occur. It is changes in the purchasing power of gold that cause, in the first place, defects in the gold standard, such as the pre-war trade cycle, and secondly, the breakdown of the gold standard, such as has occurred more than once since the War.

Professor Jones is, I think, in favour of doing something with a view to keeping the gold standard in order. He does not make it quite clear in his paper what it is that he favours in that respect, and what he says about the desirability of stabilization rather tends to throw doubt on his faith in an international gold standard. Still, I think it is fair to suppose that he would be in favour of such a degree of stabilization of an international gold standard as is obtainable. There you find a compromise which reconciles the antithesis in his title of internal and external stability. If, however, the choice is between internal and external stability, I must confess that I think that the choice should be for internal stability. The kind of evils that we suffer from through fluctuations in the standard of value are so tremendous that I think the advantages of an international gold standard are quite trifling in comparison.

I have not time to give a detailed criticism of some of the points in the second part of the paper. I think that Professor Jones is inclined to exaggerate the advantages of an international gold standard. I do not think he takes sufficient account of the advantages of a forward exchange market, by which international trade can be carried on with fluctuating standards, nor of the relatively small variations between the values of different currencies that would occur if each currency separately were stabilized in terms of commodities. My own view is that if every country separately attempted to stabilize its currency in terms of commodities, without

any fixed rate of exchange with other countries, the result would be that variations in rates of exchange would be found to be so small that the world would drift very quickly into an international gold standard again, so that in a way I regard the controversy as somewhat unreal.

SIR BASIL BLACKETT: It is with great pleasure that I rise to second the vote of thanks to Professor Jones for his extremely interesting paper. I always read with special interest and respect what Professor Jones writes on the subject of currency, because he is one of those controversialists who does his opponent the honour of believing that he has got arguments. He generally examines the other side and sees something, at any rate, of what it is driving at before he comes down heavily with his battle-axe to destroy his enemy.

I was a little disappointed, in the present paper, because I think that in this instance Professor Jones has done much less than justice to his opponents. I fancy he was in the difficulty of not knowing exactly what he was meant to talk about this afternoon, and one of the results of that is that he has taken for granted a great deal that I think inevitably enters into this controversy, in so far as it is a controversy.

I would draw attention to the difference between the conditions which he postulates for the successful working of a local standard and the successful working of an international gold standard. He says on p. 296 that "comparison should be made, not between a national currency system and the pre-war gold standard but between the former and that type of gold standard which is possible under modern conditions." On p. 298 he further assumes that "the gold standard is managed with care and efficiency by people who are aware of its problems and are anxious to use it as an instrument of economic progress." But when he is examining the working of a national currency system, he assumes that peoples and governments are doing their best to upset it, that this Government is weak, and that Central Bank either weak or unpopular, and he nowhere assumes the ideal conditions for working a national currency system—a world in which all the major nations were trying to work national currency systems based on the internal price level. He goes on the assumption that Great Britain might adopt the new price level standard with a world working on the gold standard system. It does not seem to me that that comparison is quite fair. You must assume that either Governments and Central Banks are always weak and always mistaken, whether working on a gold standard or on a national currency system, or, on the other hand, that they are doing their best in difficult circumstances in either case to make the standard work. It is quite permissible for Professor Jones to argue that the difficulties are greater in the case of a national currency system than a gold standard, but one must assume that intentions are equally honourable and likely to be effective in both sets of cases.

It is impossible in the short time at my disposal to deal justly with this extremely interesting paper. I wish first of all to deal

with one point already referred to by Mr. Hawtrey. Professor Jones doubts the advisability of a stable level of prices. I can understand those who question the possibility, but why should anyone question the desirability of a stable level of prices? Surely the ideal is that money should be neutral; that if money is to measure accurately the value of other things, it must be free from fluctuations of its own. That is the ideal at which we are aiming, that money shall not intervene to alter the values of demand and supply. If prices are fixed by demand and supply, the ideal is perhaps reached, but the trouble is that the volume and variability of money are an important element in effecting demand. If you can neutralize the effect of money on demand, you can safely leave prices to adjust themselves as between demand and supply, but if you do not neutralize that, you have inevitably fluctuations in the purchasing power of money caused by money itself, and it is our trouble that money has introduced that additional unsettling factor; I believe a great deal of the boom and depression from which we suffer is due to this unstability of money itself, and the ideal we are after is a system that will eliminate the improper effects of money and make money a neutral means of facilitating exchange, and nothing more. Whether that is attainable or not is another question.

I am inclined to agree with Mr. Hawtrey that as a matter of fact there is much less difference between Professor Jones and the advocates of controlled money than perhaps it would seem from this paper. Professor Jones says quite bluntly that it will be generally agreed that the conditions under which the pre-war system operated cannot be restored. He imagines the restoration of an international gold standard in a world with conditions very different from those of to-day; he does not precisely state what the conditions are, but they can, I think, be generally imagined from his paper. The paper contains so much that he can hardly be criticized for leaving that out, but it remains true that no one believes the international gold standard can be re-established at the present moment.

Professor Jones believes in the international gold standard because he believes it is a form of international discipline, and in the absence of gold he sees no means of disciplining the economic activities of various independent nations of the world; he rather assumes that in the absence of that discipline the present competition in depreciation will be perpetuated, as well as efforts to restore prosperity by destroying international trade. It is perfectly true that gold may do valuable service in the sort of way Professor Jones suggests, as an international discipline, but only under conditions, namely, that a gold standard is not re-established in any form in which there is risk, or people think there is risk, of a repetition of recent events. There is no good having a gold standard under which you solemnly, by Act of Parliament, undertake that the pound shall always be worth x grains of gold, and then being driven under difficulties to alter the number of grains of gold or to do without specifying the number of grains in the pound. One of the great difficulties of the gold standard up to 1931 was just that, that it was

impossible for a country that had once established itself on the gold standard to go off the gold standard without approaching something near to a national default. In the case of foreign countries which had money over here, to effect a sudden change in its value, without consulting a creditor, was an action that none of us would like to be taken again. If we do go back to the gold standard there must always be an understanding that the obligation to remain on it is not a final one, the breaking of which means the discredit of a national default. Professor Jones believes, no doubt, that we can get back ultimately to an international gold standard, but it is only on condition that the international credit control or various national Banks controlling credit, put their heads together with a view to securing that the fluctuations in the purchasing power of gold shall be so minimized that in fact there will be reasonable stability of purchasing power of money. There is extraordinarily little difference between that and going one step further and saying that each nation for itself, and in co-operation with other nations, will endeavour so to arrange its internal currency methods as to secure that there shall be very little, or no change in the internal price level. If they are doing that for themselves there will be, in effect, something very nearly approaching, if not absolute, stability of foreign exchanges. So that I come to the same point as Mr. Hawtrey: that there is a great deal of unreality in this idea that there is an absolute quarrel and dilemma between the stability of internal prices and the stability of external exchanges. All of us want both. The question is whether it can be done better by giving greater freedom to each national authority to manage its internal affairs, or by subjecting it to the sternest discipline of a gold standard, under which it is forced by the action of some other country or by some change in the supply of gold, into subjecting its nationals to an unpleasant change in the internal purchasing power of their money, not in the interests of anybody, but in the interests of a fetish of a gold standard.

I cannot follow up other points that are raised in Professor Jones's paper, but will refer to one in particular. He suggests that England was driven off the gold standard because she had borrowed short and lent on long-term, beyond her means. I am not sure that that is quite a true statement. Had we not borrowed a great deal short, and lent it short in places where it was not repaid when the time came? That is a minor point.

I should like to conclude by saying how grateful I am for Professor Jones's paper, as well as for his paper read before the British Association. I have much pleasure in seconding this vote of thanks.

SIR JOSIAH STAMP said he could easily spend the five minutes allotted to him in words of praise of Professor Jones for a paper which he felt sure would last long in discussions on this subject. It was Professor Gregory who said that all books on currency should now be written in loose-leaf ledgers, but there were some fairly permanent leaves in this paper, because it contained a searching analysis of certain aspects hitherto passed over rather lightly, and although Professor Jones would be the last to claim that he had

said the final word, he had certainly started an important new analysis.

Sir Josiah Stamp had hitherto divided his gold standard friends into four groups:—(1) The “hard-shell” gold advocates who saw the magic of gold revered by our race for thousands of years and therefore felt that it always must be, who thought that nothing else would do, and who hated new things. They were so imbued with this idea that they felt there was no other standard but a gold standard. (2) Those who said that a gold standard was not particularly good, but that the world was so weak and undeveloped that the gold standard must continue for a few generations, particularly until national governments became more honest and expert in technical management. They felt that during the interim period there must be a gold standard. (3) Those who said that this was all a part and parcel of the movement towards internationalism, and who felt that if the gold standard were to be worked in the future it would require a highly developed international mechanism to see that the rules were carried out. They felt that instead of shirking the problem, it should be developed along certain defined lines. (4) Those who said, “We are going to have a managed currency anyway, and we should manage it with a golden handle.” The gold reserves were small, and the currency should be managed much in the same way as a gold circulating currency would be managed.

To these groups it would now be necessary to add a fifth category, which he would call the Jones category, and he felt bound to say that an excellent case had been made for this category.

It would have been well if Professor Jones had put down a little more exactly and narrowly what were those international rules of the game on which he would consent to go back to gold. What were the prospects of their being observed, and what was the machinery necessary? Against that it would be possible to test the reasons put forward to indicate that a gold standard would be really successful. It was only when one got down to the task of drawing up a list of rules prescribing how the countries were to act under given conditions that it was possible to see the problems to be faced. It would be interesting if Professor Jones would discuss whether the gold standard was to be worked in sealed vessels of opaque glass, or in open glass vessels, for the economics of full public information were quite different from those of esoteric action.

To take the instance of the Macmillan Report:—that Committee had valuable information not available before, collecting a mass of statistics about the total balances in and out, to and from London, and they came to a measured conclusion that all was well. Within a few months, we were “off” from this very cause—an excess of outward obligation. It was known now that they had not the full information, and if they had known all the amounts that London branches of foreign banks were responsible for, and their “time” nature, they might even then have seen the peril that was to come.

Public statistics were creating an entirely new world of economics from that to which they had been used. They had to study how the gold standard used to behave when they had none of these things open

to knowledge and influence; if they had known, there might have been an entirely different state of affairs. It was analogous to the problem of armaments, being subject to the same procedures, and to the suggestion that an international commission should report on the resources of every nation. It might result in more armament, and not less, for it was probable that exposure of a weakness would arouse a popular desire for greater security. With regard to the gold standard there were completely different states of mind, according to whether there was completely open information or not.

Sir Josiah Stamp expressed his gratitude to Professor Jones for his admirable paper, which he believed would be the first of a series.

MR. H. V. HODSON was a little puzzled to know what in general it was that Professor Jones was attacking. Either his enemy did not exist at all, or existed in such overwhelming force that Professor Jones should have retired before entering the conflict. If every country was pursuing internal price stability, then there was no conflict between that aim and mutual exchange stability, but if that condition was not fulfilled, it would seem that the elements of conflict were far greater than was indicated in the paper. The very fact that different countries had different Central Banks, controlling through their operations the policies of what we should call the Joint Stock banks, made a great deal of difference to the way in which a correct monetary policy could be pursued. As between the North and South of England, the banks in the North relied for their reserves upon the same monetary resources as the banks in the South, and the problem of reconciling their different credit needs could not be regarded apart from the existence of this common banking institution, let alone the existence of free trade between the two areas.

In discussing these questions both of exchange and price stability, it was essential to get down to the material side of it—the form and volume of trade that one was trying to maintain nationally and internationally—since trade was, in fact, the ultimate concern of exchange stability. That was accepted but forgotten. It was accepted that one's purpose was to maintain business stability (economic equilibrium or whatever else one liked to call it), and that purpose was affected not only by monetary policy, but also by all kinds of other considerations. Purchasing power might be increased by other methods than that of Central Bank policy. Restrictive schemes, again, might alter the price structure. Hence Mr. Hodson's general reaction was a feeling that this question of internal versus external stability was in some sense artificial, and in so far as it was not artificial, but substantial and critical, it was really on the surface of what was a much deeper problem.

MR. A. P. L. GORDON said that in thanking Professor Jones for his paper he would like to congratulate him upon having proved for all time that the *bona fide* statistician was one who never used statistics. He would go further in his congratulations by saying that Professor Jones had created a controversy to end controversies. There was no real controversy between external and internal price

stability. There were many people who, because newspaper arguments could not be answered, thought that there were manifest advantages in a rapid depreciation of one's own currency. This was easily proved, and yet more easily answered when the advocate of depreciation gave his opponent the opportunity. But, from a more serious standpoint, a great number of learned folk wished to substitute for the gold standard something, not necessarily better, but at all events more complicated. He confessed that, when he was told that currency problems, or any serious problem whatever, could be solved by there being a premium on forward exchange—an assumption which obviously meant that forward exchange must not be a market in any real sense—he believed what he formerly thought, but he believed it rather more strongly.

If they were going to discuss the question of managed currencies, and if they were going to start—as Professor Jones had started—from the assumption that the object of a managed currency was to induce internal price stability—then the problem was so tremendous that the Society must first decide what was meant by internal price stability. When it had been analysed to and fro for some time, they might come to the conclusion that, for a trading nation, the real meaning was a stable balance between the purchasing power of the people regarded as consumers, and people (in the abstract) who were regarded as producers. In other words, one had to preserve, not an index-number at a reasonably stable figure, but two index-numbers in a reasonably stable relation to one another—a task of a yet more complicated kind. One of the connected problems—the allocation of weights in these indices—would assuredly afford an outlet for energies thrown out of employment by the repeal of Prohibition, and for similar influences in this country and elsewhere. It did not seem, however, that this solved any problem.

Mr. Gordon said he would like to close by underlining a remark by Professor Jones, that what the gold standard had been blamed for was, in fact, a freak of wrong values. In any market of the world, a discrepancy between price and value could only be put right by a crisis, the more severe as the market was the more important. Great Britain had an effective gold standard before the war. She came out of the war, and after a while had another gold standard. But she had failed to take into account the fact that, with the new balance of payments, the trading value of the pound was not \$4.86. The value had been disturbed by the events of the war and the peace; it was the price, and not the system, which the crisis had called in question.

MR. BALOGH said that in the heat of debate one felt tempted to turn aside to follow up the various contentious matters brought into the discussion by the previous speaker and to correct the erroneous statements made by him. He, however, would refrain from doing so because Professor Jones' admirable paper raised really fundamental issues.

He believed that most of Professor Jones's difficulties were due to the way he raised his basic question. He contrasted price stability, as an aim of currency policy, with fixed parities. It seemed

to Mr. Balogh that the proper way of analysis was first to inquire as to whether price stability was the proper object of currency policy; if so, whether it was capable of attainment, first, in a closed economy, and secondly, in a world with sub-units linked together by (a) fixed and (b) variable exchange rates. If price stability was not a desirable objective, what other aims or criteria for an optimum policy could one find? And how would they work out in the three different monetary systems mentioned above?

Unfortunately Professor Jones did not follow this simple procedure. Instead of enquiring into the real fundamental "stability in the economic system," he ran after the elusive concept of the "stability of the price level," and the very plain but unhelpful "stability of exchange rates." In the first part of the paper, which had not been read and with which the speaker therefore did not want to concern himself in detail, no use was made of the tools which the acrimonious monetary discussions gave us. Professor Jones therefore expressed beliefs and judgments about the aims and efficacy of monetary measures rather than gave a balanced analysis of the factors and processes (such as variations in the expected rate of profits, etc.) determining, influencing and possibly frustrating such control. This was a pity, because it seemed to Mr. Balogh that, in contrast to France and other continental countries, English and Scandinavian economics had already passed this stage of controversy.

In the second part of the paper the writer became entangled in difficulties also of his own making. In his main example, with which he defended the orthodox gold standard, he started with a disequilibrium, then changed most of his data and still argued as though the primordial disequilibrium had not been changed. Mr. Balogh could not understand this method at all. To argue under the assumption that the equilibrium rate of interest was not changed by a depreciation of currency (especially in a small country trading with a powerful one) was to fail to understand the whole mechanism of monetary equilibrium. In Professor Jones's example on p. 291 of the paper he talked of a rate of interest as a supply schedule not a price, altogether neglecting the demand side which was most powerfully influenced by the fact that a depreciation of the pound would reduce costs and enable England to compete in the rich French market. Under this stimulus the equilibrium rate of interest would rise and the initial international disequilibrium, contrary to Professor Jones's improbable thesis, would vanish.

The real problem was not what Professor Jones thought it to be, namely, whether disequilibria could be cured at all in the one or the other system, because they obviously could be, but which of the two systems was better suited to restore equilibrium without undue cost internally or internationally? Mr. Balogh thought it impossible to give a concise general answer. What one could probably say was that if the gold standard was restored internationally on a basis which took due account of the state of affairs in each of the sub-units (in contradistinction to stabilisations in the past decade) then it was probably true to say that powerful big countries caused more harm than good to both themselves and everybody else if they tried

to remedy any subsequent disequilibrium by varying their exchange rate rather than slowly readjusting their internal cost and price structure under the cover and pressure of a gold outflow. The uncertainties engendered by a sudden change in the external value of the currency and the sharpness of the readjustment would probably deflate the other countries and suggest competitive imitation. Small countries, especially those dependent on agriculture, where subsequent disequilibria might be both sudden and violent, better availed themselves of the more drastic method of readjustment by depreciation or appreciation of the external value of their currency.

Professor Jones had rendered great service by calling attention to these problems, even though very much remained yet to be done to clear up the theoretical basis of monetary policy in a complex world.

PROFESSOR JONES, in reply, said : It is becoming customary for readers of papers to submit their answers in writing. May I, however, now point out one or two things that appear to have been forgotten in the discussion ? One is that the subject was not selected by myself, but by the Society. I was asked to speak upon it and I interpreted the subject in a manner that seemed to me to be relevant to the practical problem that now faces the government of every country that is off the gold standard. This brings me to my second point. Sir Basil Blackett and others have suggested that there is no real controversy between the goldites and the non-goldites : that the points of agreement are more fundamental and numerous than the points of difference. But I venture to submit that a controversy is unavoidable, because the Government has to make up its mind whether it will restore the gold standard. The currency system that will be set up in this country will be determined by law, and the Government—like every other Government—has to make up its mind whether it is to be this law or that law. It must be a matter for discussion and decision at some time or other. I therefore venture to differ from those speakers who suggest that there is no real difference between the two schools of thought. Are the economists and statisticians prepared to say it does not really matter whether we go back or do not go back to gold ? If they are not prepared to say that, then I submit that there is a real question worthy of the attention of every statistician and economist in the country.

That brings me to the final observation that I venture to make, which is that what I read (namely, the second part) and the first part of the paper deal with two very dissimilar problems. I believe that the discussion suffered to some extent from the fact that I was unable to read the first part. In that connection I would also point out that it was not I who said that we have to make a comparison between a national currency system and the post-war gold standard. I merely stated there what other people were saying, and it was not a statement for which I was personally responsible.

I thank you very much for the kind way in which you have received my paper.

PROFESSOR JONES subsequently completed his reply in writing, as follows:—As I desire to be brief I venture, first, to thank the speakers for their reception of my paper and for their comments upon its substance. It was unfortunate that the length of the paper necessitated the omission, in reading, of the first part and even of a portion of the second. More than one speaker criticized the method of approach, which was explained and defended in the first part. Price stability (howsoever defined) may be regarded as either a manifestation of economic stability or a means by which the latter may be achieved and maintained. If we accept the first view we seek economic stability and use the price level merely as a barometer. If, however, we accept the second view, price stability becomes an objective almost indistinguishable from the goal. In a large book upon the subject I might have been expected to submit an adequate discussion of these views; but in a paper under the title that was selected for use it was necessary to limit the discussion by making certain assumptions. The alternatives in the title represented alternative policies advocated at present by two schools of thought. One policy is that of restoring an international currency standard, the other is that of seeking to maintain price stability, howsoever defined. I guarded myself against the ambiguity of the word stability and for the purpose of discussion gave it a precise meaning. It should not be forgotten that if price stability is to be an end, a precise definition is needed for the guidance of those in control of policy. It cannot be defined in one way to-day and in another to-morrow. But precision does not mean rigidity. For the purpose of the discussion I assumed that, if successful, the policy of maintaining price stability, howsoever defined, would also succeed in maintaining economic stability, howsoever defined. But I made that assumption, not because it was unchallengeable, but because it is implied in the general argument of the advocates of the policy. My assumption was an essential preliminary to the subsequent discussion in the second part of the paper. Such is the defence of my method. My main thesis was that the policy would not be successful in achieving its end, namely, the maintenance of a stable price level—howsoever defined, but, for the immediate purpose of the discussion, defined as an unvarying price level. The policy failed to negotiate the first hurdle. The remaining hurdles, described in the first part of the paper, were therefore not even approached. Some of the speakers would have approached the problem from the other end, so that the hurdles would have been taken in the reverse order.

I do not believe that I have over-emphasized the difference between the alternatives indicated in the title of my paper. The difference is fundamental. It is, of course, true that if every country succeeded in maintaining a stable price level (similarly defined in all cases and with the same *tempo*), exchange rates would remain unchanged and a double equilibrium achieved. But it would be an unstable equilibrium, like the exchange equilibrium of recent months. Real exchange stability represents a stable equilibrium. The burden of my argument, however, is that the success here assumed will not be achieved when it becomes the end sought by monetary policy. Price

stability is more likely to be secured by the maintenance of exchange stability than by the alternative system, although in this case stability will not mean an unvarying price level.

Nor do I believe, with Mr. Hawtrey, that a universal gold standard *plus* international banking co-operation for maintaining stability in the value (purchasing power) of gold represents a reconciliation of the two schools of thought. Under such a system the volume of currency would be determined by the supply of gold and would control the volume of credit. Under the alternative system the supply of currency would not be controlled; it would respond readily to the flow of credit without exercising the slightest influence upon the latter. For this reason they are alternatives working in different planes. We must choose between them. And it seems to me that the former represents Sir Basil Blackett's choice, as indicated in his proposal to maintain a "sterling group." It does not follow, however, that international co-operation to maintain stability in the value of gold is not desirable. On the contrary, I would welcome it as a necessary part of the new international system. But (a) stability in that sense would merely mean the absence of very marked changes in the trend of the price average; (b) it would be consistent with cyclical fluctuations; (c) currency would still be controlled by gold, and credit by currency; (d) given effective co-operation, such stability could be maintained by more than one method. I attach very little importance to the so-called "scarcity" of gold. In this connection I may add that it is impossible, in the space at my disposal, to respond to Sir Josiah Stamp's invitation to describe the technical conditions that must be fulfilled if an international standard is to be maintained. I will merely add that the essential preliminary is real peace and confidence in the political future.

I do not agree that, under "local" currency systems, the existence of a forward exchange market would provide a safeguard against excessive movements of capital. In the first place it would only be operative, if at all, in the case of short-term movements. Its effectiveness would vary inversely with the period to which the capital remained in another country and would sink to zero in the case of a long-term investment. Mr. Keynes recognized this limitation in his *Treatise on Money*. In the second place, even in the case of quick movements, it would probably prove far less effective than is commonly supposed. The difference between spot and forward rates is a function of the degree of stability expected in the near future. When the margin is small the desire to move funds is correspondingly weak; when the margin is wide the desire to move funds is correspondingly strong and the margin becomes ineffective. In time of crisis and panic, when the desire is strongest, forward exchange is unobtainable. Therein lies the difference between forward dealings in money and forward dealings in commodities. A steam roller merely laughs at a wooden fence.

I did not suggest, in my paper, that governments "favour budget deficits merely because they see their way to finance them" (Mr. Hawtrey), but rather that they would tend to pursue a policy that prevented the danger of a budget deficit. Nor do I believe that I

took an unduly pessimistic view of human nature. The public does not recognize incipient inflation, and as bank reserves are high, even bankers believe there is nothing beyond "prosperity" to be seen. What everyone sees and feels—and fears—is the effect of the check eventually imposed by banking policy; and it is precisely that check which can be avoided or postponed, and most people will want to avoid. Again, I did not, as Mr. Balogh suggests, refer to the rate of interest "as a supply schedule, not a price." I do not believe that capital in general has a supply price; its supply is not a function of price: the supply is variable but not elastic. I used the rate of interest as the actual price of capital on the market for long-term capital. I may be wrong, but I infer from Mr. Balogh's statements that the real difference between us lies in the meanings that we attach to the equilibrium rate of interest, my meaning being the rate at which the rate of investment demand is equal to the rate of supply. Mr. Hodson refers to the difference between the case of two countries, with different central banks, and the case of two parts of one country with a single central bank. He repeats the dilemma that I stated in my paper and adds that in the latter case "the problem of reconciling their different credit needs could not be regarded apart from the existence of this common banking institution." But he gives no indication of the method by which the problem is to be solved. My critical question was ignored. Finally, I did not merely assume, as Sir Basil Blackett suggests, that one country was on a "local" standard and the remainder of the world on the gold standard. I examined the situation that would be created under different assumptions.

As a result of the ballot taken during the meeting, the candidates named below were elected Fellows of the Society :—

Ernest John Gooding, B.Sc., Ph.D.
Frederick John Cleverdon Honey.
Charles Thomas Houghton.
Robertus Litt.
Douglas Henry Peacock.
Clifford J. Saunders, A.I.S.A.

Corporate Representative :

Oliver L. Lawrence, *representing* the Royal Institute of International Affairs.

WHOLESALE PRICES IN 1933.

BY THE EDITOR OF "THE STATIST."

(The *Statist's* index-numbers in continuation of
Mr. A. Sauerbeck's figures.)

IN the following table are set out the *Statist's* annual index-numbers of wholesale prices (in continuation of Mr. A. Sauerbeck's figures). The index-numbers embrace forty-five commodities, the base years being 1867-77. The annual index-numbers are calculated, with few exceptions, from the average of fifty-two weekly quotations for each commodity. The following table records the annual averages from 1846, *i.e.* from the commencement of the calculations, together with Jevons's figures adjusted to Sauerbeck's standard for the years 1810 and 1818. Until the end of 1912 the statistics were compiled by the late Mr. Augustus Sauerbeck and subsequently by the *Statist*.

THE STATIST'S *Annual Index-Numbers* (in continuation of
Sauerbeck's figures),

(1867-77 = 100.)

Year.	Average No.	Year.	Average No.	Year.	Average No.	Year.	Average No.	Year.	Average No.
1933	79	1915	108	1897	62	1879	83	1861	98
'32	80	'14	85	'96	61	'78	87	'60	99
'31	83	'13	85	'95	62	'77	94	1859	94
'30	97	'12	85	'94	63	'76	95	'58	91
'29	115	'11	80	'93	68	'75	96	'57	105
'28	120	'10	78	'92	68	'74	102	'56	101
'27	122	1909	74	'91	72	'73	111	'55	101
'26	126	'08	73	'90	72	'72	109	'54	102
'25	136	'07	80	1889	72	'71	100	'53	95
'24	139	'06	77	'88	70	'70	96	'52	78
'23	129	'05	72	'87	68	1869	98	'51	75
'22	131	'04	70	'86	69	'68	99	'50	77
'21	155	'03	69	'85	72	'67	100	1849	74
'20	251	'02	69	'84	76	'66	102	'48	78
1919	206	'01	70	'83	82	'65	101	'47	95
'18	192	'00	75	'82	84	'64	105	'46	89
'17	175	1899	68	'81	85	'63	103	'18	159*
'16	136	'98	64	'80	88	'62	101	'10	171*

* Jevons's numbers adjusted.

The annual index-number for 1933 is 79. This figure indicates a position of relative stability in 1933, showing a fall of only 1.2 per cent. from the previous year, as compared with declines (from the previous year) of 3.6 per cent. in 1932; 1.4 per cent. in 1931; 15.7 per cent. in 1930 and 4.2 per cent. in 1929. The year 1933

is the ninth consecutive year in which, according to the annual index-numbers, wholesale prices have registered a decline. The serious extent of the fall is indicated by the fact that the annual index-number for 1933 is some 43.1 per cent. below that of 1924, since when there has been a continuous decline. The economic effects of the decline in prices, however, may be more readily gauged from the fact that prices in 1933 were 31.3 per cent. lower than in the recent year of 1929. In comparison with these declines, the fall of 1.2 per cent. in 1933 from the previous year must be regarded as indicating at least a stable position. The figures immediately below give the ten-year averages of the annual index-numbers since the commencement of the calculations.

THE STATIST'S *Annual Index-Numbers—ten-year averages*
(1867-77).

1828-1837 = 93	1897-1906 = 70	1911-1920 = 146
'38- '47 = 93	'98- '07 = 71	'12- '21 = 148
'48- '57 = 89	'99- '08 = 72	'13- '22 = 153
'58- '67 = 99	1900- '09 = 73	'14- '23 = 157
'68- '77 = 100	'01- '10 = 73	'15- '24 = 162
'78- '87 = 79	'02- '11 = 74	'16- '25 = 165
'88- '97 = 67	'03- '12 = 76	'17- '26 = 164
'90- '99 = 66	'04- '13 = 77	'18- '27 = 159
'91-1900 = 66	'05- '14 = 79	'19- '28 = 152
'92- '01 = 66	'06- '15 = 82	'20- '29 = 142
'93- '02 = 66	'07- '16 = 88	'21- '30 = 127
'94- '03 = 66	'08- '17 = 98	'22- '31 = 120
'95- '04 = 67	'09- '18 = 110	'23- '32 = 115
'96- '05 = 68	'10- '19 = 123	'24- '33 = 110

In the next table are given the index-numbers of the groups and sections forming the all-commodity index-number. The two main groups, food-stuffs and materials, showed opposite tendencies in 1933 as compared with 1932. Thus, the food-stuffs index continued to decline, falling by 6.3 per cent., while that of materials reversed the tendency of previous years and rose by 2.5 per cent. The only section in the food-stuffs group to record a rise was that of animal food, which was up by slightly less than 1 per cent.; the vegetable food section was down by 16.7 per cent.; and sugar, coffee and tea by 6.0 per cent. The rise in the animal food section was attributable to increases of 10-14 per cent. in mutton prices and 10.6 and 5.8 per cent. in the prices of pork and bacon, respectively. Against these rises were declines of 6-11 per cent. in beef prices and a fall of 16.8 per cent. in the price of butter. The fall of 16.7 per cent. in the vegetable food section was mainly due to potatoes, which were down by 43 per cent. by comparison with the previous year. There were declines of about 6-8 per cent. in wheat; 1.9 per cent. in flour; 17.6 per cent. in oats; 8.6 per cent. in maize and 16.1 per cent. in rice. The only item in this group to rise was barley, which was

up by 5·8 per cent. Coffee was the principal cause of the decline of 6·0 per cent. in the sugar, coffee and tea section. Coffee was down by 19·4 per cent., while sugar was 7-10 per cent. lower. Tea, however, was up by 26 per cent.

Summary of Index-Numbers. Groups of Articles, 1867-77 = 100.

	Vegetable Food (Corn, etc.).	Animal Food (Meat, etc.).	Sugar, Coffee, and Tea.	Total Food.	Minerals.	Textiles.	Sundry Materials.	Total Materials.	Grand Total.	Silver.*	Wheat Harvest.†	Average Price of Consols.‡	Average Bank of England Rate.‡
1873.....	106	109	106	107	141	103	106	114	111	97·4	80	92½	Percent.
'96.....	53	73	59	62	63	54	63	60	61	50·5	112	110½	4·750
1909.....	71	89	50	73	86	64	76	75	74	38·9	113	83½	3·083
'10.....	65	96	54	74	89	73	81	81	78	40·5	102	81½	3·725
'11.....	70	90	61	75	93	76	81	83	80	40·4	110	79½	3·467
1912.....	78	96	62	81	110	76	82	88	85	46·1	97	76½	3·776
'13.....	69	99	54	77	111	84	83	91	85	45·3	105	73½	4·771
'14.....	75	100	58	81	99	81	87	88	85	41·6	109	72½	4·038
'15.....	108	126	70	170	126	92	109	108	108	38·9	106	65½	5·000
'16.....	133	152	86	130	158	129	136	140	136	50·4	97	58½	5·470
1917.....	177	192	113	169	172	192	174	179	175	65·8	102	54½	5·15
'18.....	168	207	130	174	192	222	202	206	192	76·4	111	56½	5·0
'19.....	179	213	147	185	220	228	219	222	206	85·3	98	54½	5·166
'20.....	227	263	198	234	295	262	244	264	251	76·1	96	47½	6·71
'21.....	143	218	83	168	181	140	145	153	155	48·1	118	47½	6·092
1922.....	107	184	82	130	142	134	124	132	131	51·6	105	56½	3·692
'23.....	98	162	101	122	155	140	117	134	129	49·4	105	57½	3·496
'24.....	119	158	105	130	158	170	120	146	139	50·7	107	56½	4·0
'25.....	118	162	89	128	154	165	119	143	136	52·5	114	56½	4·575
'26.....	108	150	88	119	154	133	114	131	126	47·1	99	54½	5·0
1927.....	108	138	83	114	141	131	118	129	122	42·8	109	54½	4·650
'28.....	107	142	78	114	123	136	117	124	120	44·0	109	55½	4·5
'29.....	99	146	72	110	126	122	111	119	115	40·2	114	54½	5·508
'30.....	77	142	54	96	112	84	97	97	97	29·0	99	56	3·4
'31.....	68	119	50	83	100	63	85	82	83	20·4	99	55½	3·975
1932.....	72	105	50	79	99	64	81	81	80	19·5	105	66½	3·017
'33.....	60	106	47	74	107	67	80	83	79	18·7	114	73½	2·0
Average 1904-13	68	91	53	73	95	74	76	81	77	44·1	106	82½	3·733
1890-99	61	80	63	68	71	56	66	64	66	55·8	103	103½	2·958
'78-87	79	95	76	84	73	71	81	76	79	82·1	97	99½	3·264
1818-27	109	90	151	111	128	105	106	112	111	98·0	—	—	3·692

* Silver (see note on p. 328), parity of 1 gold to 15½ silver = 100.

† Wheat harvest in U.K. to 1895: 29 bushels = 100; from 1896: 30 bushels = 100.

‡ Average price of Consols and the average Bank of England rate of discount are actual figures, not index-numbers; Consols 3% to 1888, 2½% from 1889, 2½% from April, 1903.

The materials group, which was up by 2·4 per cent. in 1933 by comparison with 1932, shows a rise of 8·1 per cent. in the minerals section and 4·7 per cent. in the textiles section, with a decline of 1·2 per cent. in sundry materials. The rise in minerals must be mainly attributed to tin, which was up by 47·3 per cent. Pig-iron

prices were up by just over 1.0 per cent.; copper was up by 2.3 per cent. and lead prices remained stationary. The domestic price of coal was down by 2.8 per cent. and the average export price changed little, with a decline of 0.7 per cent. The rise of 4.7 per cent. in the textiles section is mainly attributable to wool, the price of Australian wool having risen by 32.4 per cent. American cotton was up by 6.9 per cent., but Egyptian was down by 6.9 per cent. Flax registered an increase of 13.9 per cent., hemp showed a decrease of 2.9 per cent. and jute one of 8.2 per cent. Silk also was lower, by 17.1 per cent. In the sundry materials section, which was 1.2 per cent. lower, all items were lower except hides, which was up by 3.0 per cent., linseed, which was 9.8 per cent. higher, and soda and indigo, which were stationary. Leather was 3.8 per cent. down; tallow 6.4 per cent.; palm oil 11.1 per cent.; olive oil 5.3 per cent.; refined petroleum 2.4 per cent.; nitrate of soda 3.2 per cent. and timber 3.1 per cent.

The relative stability of the all-commodity index-number in 1933 is also illustrated by the course of monthly prices during the year. In the next following table are given the all-commodity index-numbers for each month since 1888. The index-numbers throughout 1933 show a slightly rising tendency and though the index-number reached in December was below the highest of the year (81.7 in July), it was still about 2.8 per cent. above the index-number in January. This certainly reverses the tendency of the previous few years, when the December index-number registered a decline by comparison with the index-number for the previous January; in 1932, for example, the decline amounted to 8.2 per cent. Another indication of the increased stability of prices is shown by the fact that the mean deviation of the monthly index-numbers in 1933 amounted to 2.0 per cent. of the annual average, as compared with 3.1 per cent. in 1932. So far as the monthly index-numbers for 1934 are available, they show a continuation of the rising tendency. It might be too much to conclude from these few symptoms that the trend of prices of the last nine years, and particularly of the last four years, is being reversed. Nevertheless, when read in conjunction with the signs of improving business, such as the reduction in unemployment in 1933, the movement of prices last year seems to encourage this view. The trend of wholesale prices, however, depends on events in the international sphere as well as on those in Great Britain or in those countries which are united with her by common currency arrangements. The realization that world-wide causes were responsible for the decline in prices, with its harmful economic effects, was one of the reasons for the summoning of the World Economic Conference in June, 1933. One of the aims of the

Conference was to adopt international measures to raise prices—whether by monetary methods or by limitation of production. The Conference failed, however, to reach agreement on vital points. Nevertheless, immediately after the suspension of the Conference, the British Government, together with the Governments of the British Dominions, issued a declaration that it was their intention to continue to pursue monetary policies designed to raise wholesale prices. The United States Government had also been taking active measures to the same end, first, by the suspension of the gold standard in March, 1933, and, secondly, by regulating the price of gold. Eventually this led to re-stabilizing the dollar (February, 1934) at a new and lower gold content, which was 59·06 per cent. of the previous parity, with power to reduce the gold content to 50 per cent. of the old parity. Thus there were efforts directed from the monetary side of the problem to raise prices. The position of those countries which still retain the gold standard may, however, prove a counterbalancing factor unless, as seems by no means improbable, they take the step of devaluating their currencies. Certain efforts were also made to raise prices from the side of limiting output and certain international conferences such as that on wheat, which followed the World Economic Conference, took place, without very much to show by way of result. Further restriction was carried out in tin and tea and a scheme of rubber restriction has recently been evolved (April, 1934). Other measures included the reduction of the acreage under cotton in the United States. In Great Britain there were restrictions on the importation of mutton and lamb, chilled beef and bacon, all designed to stop the decline in agricultural prices, if not to raise them.

Monthly Fluctuations of the Index-Numbers of 45 Commodities, 1867-77 = 100.*

	Jan.	Feb.	March.	April.	May	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
1888	70.9	70.6	69.9	69.8	68.1	67.4	69.0	70.1	71.9	72.4	72.7	73.2	70
1890	73.2	72.7	71.5	71.2	70.8	70.5	71.2	72.8	72.2	72.9	71.2	71.1	72
'91	71.1	71.5	71.7	72.4	72.8	71.8	71.6	71.9	71.7	70.7	71.4	71.4	72
'92	70.0	70.0	69.1	68.9	68.8	67.7	67.8	67.4	66.8	67.4	68.2	67.7	68
'93	68.4	69.0	68.1	67.4	67.4	67.4	67.7	67.1	68.2	68.6	67.8	67.0	68
1894	65.8	65.0	64.3	63.8	63.1	63.1	62.6	63.0	62.7	61.7	60.8	60.1	63
'95	60.0	60.0	60.8	61.7	62.5	62.4	62.8	63.3	63.5	63.3	62.3	61.2	62
'96	61.4	61.4	60.7	60.3	60.1	59.3	59.2	59.7	61.2	62.6	62.6	62.0	61
'97	62.0	61.9	61.9	61.5	61.2	61.3	61.7	63.2	63.4	62.7	62.4	62.4	62
'98	62.8	63.4	63.0	65.5	66.4	64.7	64.3	64.0	63.9	63.6	63.9	63.8	64
1899	65.4	65.8	65.6	66.1	66.6	66.9	67.9	68.3	70.0	71.5	71.6	72.3	68
1900	74.0	75.1	75.7	75.6	75.5	75.7	76.2	76.0	75.5	74.7	73.9	73.4	75
'01	72.2	71.7	71.0	70.6	70.5	69.8	69.5	69.8	69.6	69.6	69.0	68.4	70
'02	68.8	68.9	69.2	69.7	70.9	70.4	70.0	69.5	69.3	68.8	68.6	69.1	69
'03	69.5	70.2	70.4	69.4	69.6	69.5	69.5	70.0	69.1	69.0	69.0	70.0	69
1904	70.4	70.8	70.8	70.5	69.9	69.4	69.9	70.4	70.7	71.0	71.2	70.9	70
'05	71.2	71.4	71.8	72.0	71.7	72.0	72.5	72.3	72.4	73.2	74.2	74.9	72
'06	75.2	75.0	75.7	76.5	77.0	76.9	76.4	76.7	77.5	78.5	78.6	79.7	77
'07	80.0	80.7	80.0	80.7	82.4	82.0	81.1	79.4	79.1	78.8	76.7	76.2	80
'08	76.0	74.5	74.1	73.8	73.6	72.9	73.1	72.2	72.5	72.2	72.2	72.3	73
1909	72.0	71.9	72.4	74.3	75.4	75.1	75.2	74.9	74.7	75.2	75.5	76.3	74
'10	77.1	78.1	79.1	78.5	78.2	76.9	78.1	78.2	77.6	77.2	77.8	77.9	78
'11	78.5	78.6	78.9	80.0	80.3	80.0	78.9	79.5	80.3	80.7	80.6	80.9	80
'12	81.8	82.9	84.4	85.0	85.3	85.5	86.5	85.9	86.7	85.8	85.3	86.4	85
'13	86.4	86.4	86.7	86.2	85.7	84.1	84.2	85.0	85.7	84.5	83.3	83.8	85
1914	83.5	83.8	82.8	82.3	82.3	81.2	82.4	87.9	89.3	89.8	88.8	91.6	85
'15	96.4	100.9	103.7	105.9	107.2	106.4	106.4	107.0	107.8	110.0	113.1	118.4	108
'16	123.6	127.0	130.4	134.2	135.4	131.0	130.5	134.5	134.4	141.5	150.8	154.3	136
'17	159.3	164.0	169.0	173.0	175.0	180.4	176.9	175.7	176.4	180.6	182.9	185.1	175
'18	186.2	187.3	188.0	189.8	191.1	192.3	192.9	195.9	197.1	197.8	195.3	196.0	192
1919	190.1	187.7	184.7	184.6	194.6	199.4	206.4	212.7	214.8	224.3	231.0	235.2	206
'20	245.3	260.4	261.8	266.1	260.0	255.7	254.6	253.5	248.7	239.9	223.8	207.2	251
'21	197.2	183.0	177.2	169.8	162.2	155.8	158.2	154.3	149.4	138.4	136.7	133.6	155
'22	132.5	132.2	133.3	134.8	135.5	135.6	134.0	129.6	127.9	130.1	130.6	129.1	131
'23	130.2	131.9	132.7	134.0	132.2	127.9	124.8	125.0	127.8	127.7	132.4	133.2	129
1924	137.2	138.8	137.0	136.8	136.4	136.3	138.4	138.0	141.6	146.1	145.5	147.7	139
'25	144.8	143.1	140.1	137.5	135.7	131.2	134.3	132.7	132.7	130.2	132.9	130.4	136
'26	129.3	127.9	126.1	125.5	125.7	124.9	126.0	127.0	128.0	131.0	130.8	123.9	126
'27	123.1	124.1	123.6	123.3	123.8	123.1	122.0	122.8	121.5	120.6	121.5	121.4	122
'28	120.9	121.1	123.6	125.6	126.2	122.6	120.3	118.0	116.8	116.8	117.9	117.9	120
1929	117.0	120.1	120.5	116.5	113.0	113.1	115.2	113.9	112.6	111.1	108.3	108.8	115
'30	106.6	104.8	103.0	101.5	98.8	95.8	94.4	92.2	90.8	90.4	88.6	86.9	97
'31	85.7	85.5	85.5	84.4	82.2	82.6	80.2	79.1	80.7	82.3	83.0	85.4	83
'32	84.7	86.7	84.1	82.5	80.2	77.0	78.9	80.7	80.4	77.8	77.9	77.7	80
'33	77.8	77.0	77.0	78.5	80.9	81.3	81.7	81.2	80.7	80.5	79.3	80.0	79
1934	82.5	82.5	82.2										

* The average of the twelve monthly figures of each year does not necessarily coincide with the annual figures, as the latter are calculated mostly from the average of 52 weekly quotations, while the former are based on end-of-the-month prices.

The first of the next two tables sets out the monthly averages of the index-numbers by groups from 1931-March, 1934, and the second gives the quarterly index-numbers (average of three months) for the years 1922-33 by groups. In neither case need the average for a year correspond with the annual index-numbers, as the former are based on end-of-month prices and the latter, as far as possible, on fifty-two weekly quotations :

THE STATIST'S *Index-Numbers—monthly averages by groups*
(1867-77 = 100).

	Vegetable Food.	Animal Food.	Sugar, Tea, and Coffee.	Food-stuffs.	Minerals.	Textiles.	Sundry Materials.	Materials.	All Commodities
1931.									
Jan. ...	68.1	131.5	50.6	87.8	102.8	61.2	89.1	84.2	85.7
Feb. ...	69.0	124.3	48.6	85.1	104.6	62.8	90.4	85.7	85.5
March ...	69.9	126.1	46.5	85.7	102.8	64.0	89.8	85.4	85.5
April ...	69.9	127.1	48.7	86.5	100.1	63.2	86.0	82.8	84.4
May ...	67.8	123.0	49.1	84.2	96.0	59.8	86.1	80.7	82.2
June ...	70.8	119.9	48.6	84.2	99.7	61.3	84.6	81.5	82.6
July ...	66.4	118.9	46.5	81.6	96.4	59.1	83.0	79.2	80.2
Aug. ...	66.5	118.2	43.7	80.8	99.2	55.6	80.6	77.9	79.1
Sept. ...	68.0	115.1	50.8	81.8	99.9	61.0	81.1	79.9	80.7
Oct. ...	73.7	108.4	51.5	81.8	100.4	64.4	84.7	82.7	82.3
Nov. ...	76.0	105.1	53.6	82.0	102.4	66.0	84.9	83.8	83.0
Dec. ...	77.6	110.2	55.9	85.0	103.7	68.4	86.8	85.7	85.4
1932.									
Jan. ...	77.0	108.3	53.5	83.6	104.0	69.0	85.7	85.5	84.7
Feb. ...	83.3	111.1	52.1	87.0	102.6	67.8	90.1	86.7	86.7
March ...	81.7	108.2	50.9	85.0	96.8	65.8	87.6	83.4	84.1
April ...	84.2	108.0	51.2	86.0	96.6	62.4	81.9	78.7	82.5
May ...	80.4	110.0	50.7	85.0	94.5	57.5	77.9	76.7	80.2
June ...	68.2	104.8	48.8	77.6	94.2	58.2	78.9	76.6	77.0
July ...	69.9	107.9	48.7	79.4	96.6	60.3	80.4	78.6	78.9
Aug. ...	66.9	104.6	49.9	77.2	101.9	70.8	80.5	83.3	80.7
Sept. ...	67.8	103.3	50.3	77.2	103.4	66.5	81.2	82.7	80.4
Oct. ...	65.9	95.3	50.0	73.4	101.1	65.3	79.7	81.1	77.8
Nov. ...	64.8	96.2	48.9	73.0	102.2	64.5	80.6	81.4	77.9
Dec. ...	61.8	103.1	46.4	73.7	100.2	63.6	80.3	80.5	77.7
1933.									
Jan. ...	63.2	104.3	45.1	74.5	99.9	63.2	80.2	80.3	77.8
Feb. ...	59.9	105.1	47.5	74.0	99.4	60.8	79.7	79.2	77.0
March ...	57.5	108.7	49.3	74.6	99.9	61.9	77.5	78.8	77.0
April ...	58.6	110.9	47.9	75.6	103.9	64.3	77.8	80.7	78.5
May ...	58.5	108.2	48.0	74.6	112.1	69.5	81.7	85.4	80.9
June ...	60.3	106.1	46.4	74.2	113.2	72.3	80.0	86.5	81.3
July ...	62.3	105.9	46.9	75.1	110.7	72.4	81.2	86.5	81.7
Aug. ...	62.6	106.2	47.9	75.6	110.7	71.2	79.4	85.3	81.2
Sept. ...	61.0	105.4	48.8	74.8	111.6	69.3	79.5	85.0	80.7
Oct. ...	59.3	105.7	48.6	74.2	111.8	68.6	80.2	85.1	80.5
Nov. ...	58.1	105.0	46.7	73.0	110.5	66.9	79.4	83.9	79.3
Dec. ...	58.2	108.4	46.8	74.3	110.5	67.5	79.4	84.1	80.0
1934.									
Jan. ...	59.6	111.8	52.6	77.3	111.2	72.9	80.1	86.2	82.5
Feb. ...	59.7	111.3	53.2	77.3	111.5	73.9	79.3	86.3	82.5
March ...	58.8	107.3	53.1	75.5	112.5	74.0	80.4	87.0	82.2

*Quarterly Movements of Prices.**
Summary of Index-Numbers, 1867-77 = 100.

Years.	Quar- ters.	Vegetable Food (Corn, etc.).	Animal Food (Meat, etc.).	Sugar, Coffee, and Tea.	Total Food.	Min- erals.	Tex- tiles.	Sund- ry Materials.	Total Materials.	Grand Total.	Sil- ver.†
1922	I	114.0	177.0	75.9	129.2	132.2	142.4	131.8	135.2	132.7	49.7
	II	116.0	199.5	80.3	139.2	134.7	136.0	128.3	132.4	135.3	52.9
	III	102.4	182.8	82.8	127.9	138.3	139.7	123.3	132.2	130.5	53.2
	IV	98.7	176.0	87.6	124.9	141.1	145.1	120.7	133.7	129.9	50.3
'23	I	94.0	175.3	100.6	125.3	154.4	139.4	122.2	136.2	131.6	50.1
	II	96.1	164.0	110.2	124.0	156.6	141.9	120.3	136.6	131.4	50.5
	III	100.3	157.7	96.2	120.6	149.0	134.8	113.9	129.7	125.9	48.2
	IV	101.1	152.0	105.1	120.7	158.9	153.5	115.0	138.7	131.1	48.8
'24	I	115.1	146.2	111.5	126.6	169.0	159.6	121.0	145.9	137.7	48.8
	II	118.3	155.3	97.2	127.5	156.7	165.2	118.4	143.1	136.5	49.9
	III	121.8	159.7	99.7	131.1	157.1	173.1	117.3	145.2	139.2	51.6
	IV	124.5	160.0	108.3	138.4	163.9	182.7	122.5	152.2	146.4	52.4
'25	I	129.0	165.6	98.8	136.1	157.0	171.6	123.9	147.5	142.7	51.6
	II	116.6	164.8	86.7	128.1	150.5	157.8	119.8	139.7	134.8	51.5
	III	112.6	163.3	83.5	125.2	153.9	159.2	117.3	140.1	133.8	53.3
	IV	108.9	155.1	82.6	120.4	153.7	159.8	114.5	139.0	131.2	53.1
'26	I	103.9	152.4	86.8	118.1	150.3	148.8	147.7	134.8	127.8	50.6
	II	104.1	155.0	88.4	119.5	148.0	135.7	113.7	129.7	125.4	49.3
	III	106.8	154.2	88.2	120.3	166.1	126.4	114.1	131.9	127.0	47.4
	IV	109.3	144.4	88.9	117.9	192.0	115.8	115.9	136.4	128.6	41.2
'27	I	108.1	143.4	85.4	116.1	155.0	120.7	118.3	128.9	123.6	43.0
	II	111.6	145.9	82.6	118.1	140.7	127.9	118.2	127.2	123.4	43.0
	III	106.9	138.1	80.8	112.9	133.3	139.8	118.1	128.8	122.1	42.1
	IV	104.5	132.1	82.0	110.0	132.8	138.6	120.6	129.5	121.2	43.3
'28	I	108.9	143.8	80.3	115.7	123.6	136.7	120.6	126.3	121.9	43.2
	II	118.0	152.0	81.1	122.8	122.9	140.6	117.9	126.3	124.8	44.7
	III	101.1	142.0	77.9	111.2	121.0	135.3	116.7	123.6	118.4	44.3
	IV	101.9	138.1	76.3	109.8	126.0	131.5	115.3	123.5	117.5	43.7
'29	I	102.9	142.7	75.4	111.8	130.2	130.7	116.6	124.6	119.2	42.8
	II	92.8	148.3	73.2	109.1	125.0	121.2	111.1	117.9	114.2	41.1
	III	99.9	143.4	71.7	110.0	126.9	115.6	111.1	116.7	113.9	39.6
	IV	91.3	145.2	64.2	105.4	122.9	107.9	108.7	112.3	109.4	37.3
'30	I	80.8	152.1	58.3	102.3	121.1	96.4	104.9	106.7	104.8	33.0
	II	76.7	142.4	56.5	96.5	110.8	92.4	99.5	100.4	98.7	29.8
	III	77.4	132.1	48.6	91.5	109.0	77.3	94.6	94.6	92.5	26.8
	IV	71.9	130.0	51.7	89.0	103.4	68.9	91.6	88.3	88.6	26.5
'31	I	69.0	127.3	48.6	86.2	103.4	62.7	89.8	85.1	85.6	21.8
	II	69.5	123.3	48.8	85.0	98.6	61.4	85.6	81.7	80.1	21.3
	III	70.0	117.4	47.0	81.4	98.5	58.6	81.6	79.0	83.0	21.9
	IV	75.7	107.9	53.7	82.9	102.2	66.9	85.4	84.1	83.6	21.5
'32	I	80.7	109.2	52.2	83.2	101.1	67.5	87.8	85.2	85.2	21.0
	II	77.6	107.6	50.2	82.9	95.1	59.4	79.6	77.3	79.9	19.4
	III	68.2	105.3	49.6	77.9	100.6	65.9	60.7	81.5	80.0	19.4
	IV	64.2	98.2	48.4	73.4	101.2	64.5	80.2	81.0	77.8	18.4
'33	I	60.2	106.0	47.3	74.4	99.7	62.0	79.1	79.4	77.3	18.2
	II	59.1	108.4	47.4	74.8	109.7	68.7	79.8	84.2	80.2	20.0
	III	62.9	105.8	47.9	75.2	111.0	71.0	80.0	85.6	81.2	18.5
	IV	58.5	106.4	47.4	73.8	110.9	67.7	79.7	84.4	79.9	18.5

* The averages of the four quarterly figures to each year do not necessarily coincide with the annual averages, as the latter are based as far as possible on average weekly prices. See also the *Journal*, 1893, p. 221; 1895, p. 144; 1901, p. 90; and 1909, p. 70.

† Silver, parity of 1 gold to 15½ silver = 100.

Construction of the Tabular Statements.

The following table illustrates the method of construction of the index-numbers. The index-numbers here given are based on the average prices for the eleven years 1867-77. Take, for instance, the *Gazette* price of English wheat:—

	<i>s.</i>	<i>d.</i>	
Average, 1867-77 ...	54	6	= 100, average point.
„ 1914 ...	35	0	= 64, or 36 per cent. below the average point.
„ 1920 ...	80	7	= 148, „ 48 „ above „ „
„ 1926 ...	53	3	= 98 „ 2 „ below „ „

The individual index-numbers, therefore, represent simple percentages of the average point.

The articles are grouped in six categories:—

		1867-77. Total Numbers.	Example for 1933.	
			Total Numbers.	Average.
1. Vegetable food, corn, etc. (wheat flour, barley, oats, maize, potatoes, and rice) ...	8 Index-nos.	800	479	60
2. Animal food (beef, mutton, pork, bacon, and butter) ...				
3. Sugar, coffee, and tea ...				
1-3. <i>Food</i> ...	19 „	1,900	1,408	74
4. Minerals (iron, copper, tin, lead, and coal) ...	7 „	700	750	107
5. Textiles (cotton, flax, hemp, jute, wool, and silk) ...				
6. Sundry materials (hides, leather, tallow, oils, soda, nitrate, in- digo, and timber) ...				
4-6. <i>Materials</i> ...	26 „	2,600	2,159	83
<i>General Average</i> ...	45 „	4,500	3,567	79

The general average is drawn from all forty-five descriptions, which are treated as of equal value, and is the simple arithmetical mean as shown above. In the following pages (pp. 322-327) are given the average prices and index-numbers for all the commodities comprised in the *Statist's* all-commodities index-number since 1912. The method of construction and the index-numbers of the silver index are given on p. 328. Estimates of the world production of silver and the world production of gold are given in subsequent tables.

Average Prices of Commodities.*

No. of Article }	0	1		2	3	4	5	6	7	8	1-8	9		10
		Wheat.			Flour.	Barley.	Oats	Maize ‡	Potatoes †	Rice.	Veg- table Food.	Beef. ‡		
		English Gazette.	Ameri- can.	Town Made white (Nov "G.R.")	English Gazette.	English Gazette.	Ameri- can Mixed.	Good English.	Rangoon Coorgoes to Arrive.	Total	Prime	Mid- dling.		
Year.	Silver. †	s. and d. per qr.	s. and d. per qr.	s. per sack (280 lbs)	s. and d. per qr.	s. and d. per qr.	s. per qt	s. per ton.	s. and d. per cwt.	Total	d. per 5 lbs.	d. per 8 lbs.		
1873 ...	59½	58-8	63	51	40-5	25-5	30	160	9-6	—	65	56		
1913 ...	27½	31-9	36-5	30½	27-3	19-1	23½	78	8-2	—	54	49		
'14 ...	25½	35-0	40-1	33½	27-2	21-0	29½	71½	9-1	—	56½	52½		
'15 ...	23½	53-11	59-10	49	37-4	30-9	41½	93½	13-3	—	72½	67½		
'16 ...	31½	58-5	67-7	52½	51-7	33-5	52½	153½	16-10	—	81½	76½		
'17 ...	40½	75-9	83-3	58½	64-10	51-7	71½	186½	25-3	—	104½	101		
'18 ...	47½	72-9	78-7	46½	59-0	49-3	78½	142½	26-2	—	103	103		
'19 ...	57	72-10	74-10	46½	75-8	52-3	78½	198½	25-10	—	108	108		
'20 ...	61½	80-7	92-4	66	90	57-4	90½	242½	41-10	—	125	125		
'21 ...	36½	72-9	73-9	64½	54-4	34-5	38½	198	18-5	—	115	109½		
'22 ...	34½	47-10	52-11	45½	40-1	29-1	31½	130	14-10	—	88½	82		
'23 ...	31½	42-2	47-3	39½	33-8	26-8	36	101	14-10	—	79½	74½		
'24 ...	34	49-3	53-9	43	46-9	27-2	39½	186	16-9	—	82½	76½		
'25 ...	32½	52-2	62-4	50½	42-0	27-2	38½	154	16-0	—	80	73½		
'26 ...	28½	53-3	58-9	49½	36-11	25-1	29½	127	16-3	—	74	67		
'27 ...	26½	49-3	58-3	44½	42-0	25-4	30½	136	15-11	—	70	62		
'28 ...	26½	44-8	50-10	40½	39-0	29-0	38½	133	15-0	—	74	66½		
'29 ...	24½	42-2	51-3	38½	35-5	24-7	36½	111	14-3	—	71	66		
'30 ...	17½	34-3	36-10	33½	28-3	17-2	23	93	13-0	—	73	68		
'31 ...	14½	24-0	25-1	22½	28-0	17-8	15½	146	9-8	—	67	61		
'32 ...	17½	25-0	27-5	24½	27-1	19-3	18½	152	9-8	—	65	59		
'33 ...	18½	22-10	25-7	23½	28-7	15-10	17½	86	7-9	—	61	52		
Average 1904-13	26½	31½	36	30	25½	18½	24½	78	7½	—	51	44½		
1890-99	34	28½	31½	27½	25½	17½	19½	72	6½	—	47	37		
'78-87	60	40	43½	34½	31½	21	25	102	8	—	55½	46		
'67-77	58½	54½	56	46	39	26	32½	117	10	—	59	50		

Index-Numbers (or Percentages) of Prices, the Average of 1867-77 being 100.

1873 ...	97-4	108	113	104	104	98	92	137	95	851	110	112
1913 ...	45-3	58	65	66	70	73	73	67	82	554	92	98
'14 ...	41-6	64	72	73	70	81	90	61	91	602	96	105
'15 ...	38-9	99	107	106	96	118	128	80	132	866	122	136
'16 ...	50-4	107	121	114	132	128	163	131	168	1,064	138	154
'17 ...	65-8	139	149	127	166	199	221	160	252	1,413	177	202
'18 ...	76-4	134	140	102	151	190	241	122	262	1,342	174	207
'19 ...	85-3	134	134	102	194	201	242	170	258	1,435	183	216
'20 ...	76-1	148	165	143	231	221	279	207	418	1,812	212	250
'21 ...	48-1	133	132	140	139	132	118	169	184	1,147	195	220
'22 ...	51-6	88	95	100	103	112	96	111	148	853	150	164
'23 ...	49-4	77	84	86	86	103	111	86	148	781	134	149
'24 ...	50-7	90	96	95	120	105	122	159	167	954	139	152
'25 ...	52-5	96	111	109	108	105	119	132	160	940	136	147
'26 ...	47-1	98	105	107	95	96	92	109	163	865	125	134
'27 ...	42-8	90	104	98	108	97	95	116	159	867	119	124
'28 ...	44-0	82	91	87	100	112	118	114	150	854	125	133
'29 ...	40-2	77	91	84	91	95	112	95	143	788	120	132
'30 ...	29-0	63	66	72	72	66	71	79	130	619	124	136
'31 ...	20-4	44	45	50	71	68	48	125	93	544	114	122
'32 ...	19-5	46	49	53	69	74	58	130	93	572	110	118
'33 ...	18-7	42	46	52	73	61	53	74	78	479	103	104

* The annual prices are the average monthly or weekly quotations, except potatoes, which are the average weekly quotations during the eight months January to April and September to December.

† Not included in the general average.

‡ Meat (9-13), by the carcass, in the London Central Meat Market.

§ La Plata from 1924.

Average Prices of Commodities—Contd.

No. of Article	11 Mutton.		12	13	14	15	9-15	16A	16B	17	18A*	18B*	18
				Pork.	Bacon.	Butter.			Sugar.			Coffee.	
	Prime.	Mid- dling.		Large and Small, average.	Water- ford.	Fries- land, Fine to Finest.	Animal Food. Total.	British West Indian Refining || s. per cwt.	Beet, German, 88 p. c., f.o.b. s. per cwt.	Java, Floating Cargoes. s. per cwt.	Ceylon Planta- tion, Low Mid- dling.† s. per cwt.	Rio, Good. s. per cwt.	Mean of 18A and 18B.
Year.	d. per 8 lbs.	d. per 8 lbs.	d. per 8 lbs.	d. per 8 lbs.	s. per cwt.	s. per cwt.							
1873 ...	71	63	54	81	123	—	—	22½	25	28	100	86	—
1913 ...	62	56	55	77	119	—	—	9½	9½	10½	81	53	—
'14 ...	64	57½	49	75½	120	—	—	11½	12½	13½	79	45	—
'15 ...	75½	69½	72	93½	141	—	—	14½	17½†	18½	78½	43½	—
'16 ...	93½	86½	87½	109½	191	—	—	24½	22½†	26½	77½	50	—
'17 ...	114½	109½	110½	148	216	—	—	31½	25½†	32½	94½	58	—
'18 ...	109½	109½	128½	183	247½	—	—	33	26½†	35½	128½	69	—
'19 ...	114	114	128	190½	252	—	—	38½	34½†	43½	145½	114½	—
'20 ...	144½	144½	168½	239½	301	—	—	58	65½†	74½	148	111½	—
'21 ...	130½	125½	121½	179	250	—	—	19½	18½†	22	120½	63	—
'22 ...	125	121½	101	145½	202½	—	—	15	14½	15½	120½	74½	—
'23 ...	114½	107½	89	113½	186	—	—	25½	23½	24½	117½	55	—
'24 ...	111½	103½	70	106	211	—	—	23½	20½	21½	152½	85½	—
'25 ...	106½	98½	84½	128½	206½	—	—	16½	11½	12½	153½	98½	—
'26 ...	89	80½	98½	130	173	—	—	16½	11½	12½	154½	89½	—
'27 ...	86	79½	85	102½	178	—	—	16½	12½	13½	143½	71½	—
'28 ...	92½	87	77	101½	185½	—	—	13½	10½†	11½	143½	81½	—
'29 ...	89½	83	91	116½	180½	—	—	11½	8½	8½	141½	74½	—
'30 ...	92	86	89	105½	146½	—	—	8½	5½†	6½	106½	42½	—
'31 ...	79	73	65	83½	130	—	—	7½	5½†	6½	101½	33½	—
'32 ...	63	55	54	77	120½	—	—	7½	5½†	5½	105½	54½	—
'33 ...	69	63	60	81½	105½	—	—	7½	4½†	5½	86½	42½	—
Average													
1904-13	58½	51½	47½	67	113	—	—	10½	10½	12	75½	43½	—
1890-99	54½	41½	42½	59	100	—	—	11½	11½	13½	98	62	—
'78-87	64½	53	49	71	116	—	—	17	18	21½	78	52	—
'67-77	63	55	52	74	125	—	—	23	24	28½	87	64	—
Index-Numbers (or Percentages) of Prices, the Average of 1867-77 being 100.													
1873 ...	113	114	104	109	98	760		101	98	115	134	125	
1913 ...	99	102	105	104	95	695		40	38	93	83	88	
'14 ...	102	105	94	102	96	700		50	48	91	70	81	
'15 ...	119	127	138	126	113	881		67	66	90	68	79	
'16 ...	148	157	169	148	153	1,067		100	93	90	78	84	
'17 ...	182	199	212	200	173	1,345		121	115	109	91	100	
'18 ...	174	199	248	247	198	1,447		127	125	148	110	129	
'19 ...	181	207	246	258	202	1,493		155	153	167	180	174	
'20 ...	230	263	324	324	241	1,844		263	262	170	174	172	
'21 ...	208	228	234	242	200	1,527		81	77	140	98	119	
'22 ...	199	221	194	196	162	1,286		62	54	140	116	128	
'23 ...	182	196	171	154	149	1,135		104	87	135	88	111	
'24 ...	177	188	135	143	169	1,103		93	75	175	133	154	
'25 ...	169	180	162	174	165	1,133		60	43	176	154	165	
'26 ...	141	146	190	176	138	1,050		60	44	178	139	159	
'27 ...	136	145	163	138	142	967		62	47	165	112	139	
'28 ...	146	158	148	137	149	996		51	40	165	127	146	
'29 ...	142	151	175	157	144	1,021		42	31	162	117	140	
'30 ...	146	155	171	143	117	992		31	22	123	66	95	
'31 ...	125	133	125	113	104	836		29	23	120	53	87	
'32 ...	100	100	104	104	101	737		27	20	121	85	103	
'33 ...	110	114	115	110	84	740		25	18	100	66	83	

* Index-numbers not included in general average.

† East India good middling from 1908.

‡ Raw Centrifugals, 96 per cent. Pol., from 1924.

† Comparative values.

|| White Javas, C.I.F., from 1924.

Average Prices of Commodities—Contd.

No. of Article. }	19A*	19C*	19B*	19	16-19	1-19	20A	20B	21	22	—	23
	Tea.				Sugar, Coffee, and Tea. Total.	Food. Total.	Iron.		Bars, Com- mon. £ per ton.	Copper.		Tins. £ per ton.
Year.	Congou, Com- mon. d. per lb.	Indian, Good Medium. d. per lb.	Average Import Price. d. and dec. per lb.	Mean of 19A and 19B.			Scottish Fig. s. and d. per ton.	Cleveland (Mid- dle- brough) Fig. s. and d. per ton.		Stand- ard. £ per ton.	English Tough Cake. £ per ton.	
1873 ...	12	—	16·67	—	—	—	117·3	—	12½	84	92	132
1913 ...	5	8½	9·06	—	—	—	65·6	58·3	7½	68	73½	201
'14 ...	6	8½	9·19	—	—	—	57·1	51·0	7	59½	64½	151
'15 ...	8½	10½	11·01	—	—	—	71·2	65·2	10½	72½	82½	164
'16 ...	8	10½	11·29	—	—	—	90·0	84·0	13½	115½	134	182
'17 ...	16½	15½	14·68†	—	—	—	95·7	89·7	13½	124½	136½	238
'18 ...	20½	16	15·0	—	—	—	101·0	95·0	14	115½	126	331
'19 ...	13½	15	15·5	—	—	—	143·1	137·1	19½	92	99½	257
'20 ...	11½†	9½	14·97	—	—	—	214·11	208·11	28½	97½	112½	302
'21 ...	4½	7	12·4	—	—	—	168·6	137·4	19½	69½	72½	171
'22 ...	8½	13½	14·9	—	—	—	99·10	90·7	11½	63½	66½	162
'23 ...	11	17½	17·58	—	—	—	108·0	108·9	11½	65½	69½	206
'24 ...	9½	17½	19·0	—	—	—	96·8	88·2	12½	63½	67½	251
'25 ...	7½	14½	18·24	—	—	—	83·4	72·8	11½	61½	65½	267
'26 ...	7½	16½	18·82	—	—	—	87·2	87·6	11½	58½	63½	297½
'27 ...	6½	14½	18·58	—	—	—	80·5	73·0	11½	55½	60½	303½
'28 ...	6½	12½	16·84	—	—	—	69·9	65·9	9½	63½	66½	229½
'29 ...	6½	11½	16·11	—	—	—	74·0	70·3	9½	75½	78½	207½
'30 ...	5½	9½	15·12	—	—	—	76·0	67·0	9½	54½	58½	144½
'31 ...	4½	6½	13·29	—	—	—	71·0	58·6	10½	38½	39½	121½
'32 ...	4½	5½	10·75	—	—	—	68·2	58·6	10	31½	33½	140
'33 ...	6½	8½	11·87	—	—	—	66	62·3	9½	32½	34½	202½
Average 1904-13	7½	7½	8½	—	—	—	57½	51½	6½	67½	72	164½
1890-99	4½	7½	9½	—	—	—	47	41½	5½	50	53	81
'78-87	6½	—	12½	—	—	—	46	38	5½	55	60	89
'67-77	11½	—	17½	—	—	—	69	60	8½	75	81	105

Index-Numbers (or Percentages) of Prices, the Average of 1867-77 being 100.

1873 ...	107	—	97	102	426	2,037	170	—	152	112	—	126
1913 ...	44	—	52	48	214	1,463	96	—	94	91	—	191
'14 ...	53	—	53	53	232	1,534	84	—	85	79	—	144
'15 ...	71	—	64	69	281	2,028	106	—	128	97	—	156
'16 ...	74	—	65	68	345	2,476	135	—	166	154	—	173
'17 ...	150	—	85	117	453	3,211	144	—	166	166	—	227
'18 ...	186	—	87	137	518	3,307	152	—	170	154	—	315
'19 ...	120	—	90	105	587	3,515	217	—	234	123	—	245
'20 ...	100	—	88	94	791	4,447	329	—	343	130	—	288
21 ...	39	—	72	55	332	3,006	237	—	232	92	—	163
'22 ...	77	—	86	82	326	2,465	148	—	136	84	—	154
'23 ...	98	—	102	100	402	2,318	168	—	144	88	—	196
'24 ...	82	—	110	96	418	2,475	143	—	152	84	—	239
'25 ...	70	—	106	88	356	2,429	121	—	144	82	—	254
'26 ...	69	—	109	89	352	2,267	135	—	139	77	—	283
'27 ...	60	—	108	84	332	2,166	119	—	136	74	—	289
'28 ...	56	—	98	77	314	2,164	105	—	120	85	—	219
'29 ...	54	—	93	74	287	2,096	112	—	118	101	—	198
'30 ...	46	—	88	67	215	1,826	111	—	121	73	—	138
'31 ...	42	—	78	60	199	1,579	100	—	123	52	—	115
'32 ...	38	—	62	50	200	1,509	98	—	121	43	—	131
'33 ...	58	—	68	63	189	1,408	99	—	117	44	—	193

* Index-numbers not included in the general average.

† Approximate.

‡ Nominal.

Average Prices of Commodities—Contd.

No. of Article }	24	25A		25B	26	20-26	27		28	29A		29B	30A	30B	31
		Lead.	Coal.			Minerals.	Cotton.		Flax.	Petrograd.¶	Russian Average Import Price.	Manila Fair Roping.	Petrograd Clean.	Good Medium.†	
Year.	English Fig.	Wallsend Hetton in London, s. per ton.	Newcastle Steam, s. per ton.	Average Export Price. s and dec. per ton.	Total.		Mulding American d. per lb.	Fair Dholerah.¶ d. per lb.							£ per ton.
1873 ...	23½	32	—	20-90	—	9	6½	47½	44	43	36	18			
1913 ...	19½	21½	15½	13-94	—	7-01	5½	34	41½	31½	38	26½	43	27½	
'14 ...	19½	21½	14½	13-65	—	6-41	4½	33	38	26½	43	27½	43	27½	
'15 ...	24	30½*	21½	16-96	—	5-87	4½	59½	66½	41½	60½	21½			
'16 ...	32½	27½*	41½	24-64	—	9-00	7	76½	85½	54½	71	31			
'17 ...	32½	27½*	30	27-16	—	16-55	13½	113½	151½†	84½	105½	39½			
'18 ...	32½	33-6	33½	30-6	—	22-3	17½	120½	156½	99½	166½	39½			
'19 ...	29½	45-3	45½	46-2	—	19-65	14½	120½	174½	58½	147½	50½			
'20 ...	40	32	51½	79-8	—	23-14	13½	120½	345½	65½	145½	44½			
'21 ...	24½	32½	29	34-83	—	9-4	5½	112½	118½	40½	145½	27½			
'22 ...	25½	34½	24½	24-16	—	12-10	8	95	84½	33½	57½	30½			
'23 ...	28½	32½	28	25-13	—	15-25	10	83½	84½	33½	57	26			
'24 ...	35½	27½	22½	23-38	—	16-26	11-03	120	104½	44	81	31½			
'25 ...	37½	29½	16½	20-08	—	12-64	11-01	92½	120½	46½	89½	49½			
'26 ...	32½	**30½	**16½	18-59	—	9-40	7-75	65	72½	43	74½	43½			
'27 ...	25½	23½	14½	17-80	—	9-54	8-27	95½	74½	43½	66½	32½			
'28 ...	22½	21½	13½	15-67	—	10-92	8-66	98½	91½	37½	63½	33½			
'29 ...	24½	23½	15½	16-13	—	10-26	7-73	76½	71½	37½	61	32			
'30 ...	19½	24½	14½	16-64	—	7-49	5-12	53½	60½	26½	48½	20			
'31 ...	14½	24½	13½	15-98	—	5-90	4-60	36	35½	18½	27½	15½			
'32 ...	13½	23½	13½	16-27	—	5-24	4-85	45½	42½	18½	36	16½			
'33 ...	13½	22½	13½	16-08	—	5-54	4-53	51½	48½	15½	37	14½			
Average															
1904-13	15½	18½	11½	11½	—	6½	5	32½	36½	30½	31½	18½			
1890-99	12	17½	10½	10½	—	4½	3	27	27	26½	25	12½			
'78-87	14	16½	8½	9	—	6	4½	33	34	35½	26½	15			
'67-77	20½	22	12½	12½	—	9	6½	46	48	43	35	19			

Index-Numbers (or Percentages) of Prices, the Average of 1867-77 being 100.

1873 ...	117	145	—	167	989	100	92	97	101	95
1913 ...	93	98	—	112	775	78	84	80	89	140
'14 ...	95	97	—	109	693	71	67	76	89	143
'15 ...	117	140	—	136	880	65	64	134	130	111
'16 ...	159	125	—	197	1,109	100	104	172	161	163
'17 ...	158	125	—	217	1,203	183	201	282	243	207
'18 ...	158	153	—	245	1,347	248	253	294	341	207
'19 ...	143	206	—	370	1,538	218	219	313	264	264
'20 ...	195	145	—	638	2,068	257	203	495	270	236
'21 ...	118	147	—	279	1,268	104	86	246	237	145
'22 ...	123	156	—	193	994	134	118	191	116	162
'23 ...	139	147	—	201	1,083	169	148	179	116	137
'24 ...	175	125	—	187	1,105	181	163	239	160	167
'25 ...	183	135	—	161	1,080	140	163	227	174	261
'26 ...	157	138	—	149	1,078	104	115	147	151	231
'27 ...	125	105	—	142	990	106	123	181	141	172
'28 ...	109	97	—	125	860	121	128	203	130	178
'29 ...	117	106	—	129	881	114	114	157	126	168
'30 ...	95	113	—	133	784	83	76	121	96	105
'31 ...	71	112	—	127	700	66	68	76	58	84
'32 ...	65	106	—	130	694	58	72	93	70	85
'33 ...	65	103	—	129	750	62	67	106	68	78

* Approximate prices.

† Approximate.

‡ Nominal.

§ Best Yorkshire house after 1916.

|| Now No. 1 Comra, Fine.

¶ Livonian Z.E.K. from 1921.

** Average price January-April, 1926.

†† Lightnings from 1931.

(a) Russian Siretz Group 1, Sort 1 from 1931.

Average Prices of Commodities—Contd.

No. of Article	32A 32B 33			34	37-34	35A	35B	35C	36A	36B	37
	Wool.			Slk.			Hides.		Leather.		Tallow.
Year.	Merino, Port, Phillip, Average Fleeced. d. per lb.	Merino, Adelaide, Average Greasy. d. per lb.	English, Lincoln Half Hogs. d. per lb.	Tsantlee. † s. per lb.	Textiles. Total.	River Plate, Dry. d. per lb.	River Plate, Salted. d. per lb.	Average Import Price. d. and dec. per lb.	Dressing Hides. d. per lb.	Average Import Price. d. per lb.	Town. s. per cwt.
1873 ...	25	11½	24½	21½	—	11	8½	—	18½	—	44
1913 ...	18	9½	12	11	—	12½	9½	8-62	19½	19½	34½
'14 ...	18½	9½	12	10½	—	13½	9½	9-11	21½	19½	31½
'15 ...	21½	10½	17	9½	—	13	11	10-04	28½	21½	36½
'16 ...	32½	16½	20	16½	—	14½	13½	11-70	28½	27	46½
'17 ...	46½	23½	20½	21½	—	20	16	15-52	35	34½	62½
'18 ...	47½	23½	18½	25½	—	20½	13½	15-9	32½	32½	81½
'19 ...	67	32½	22½	26	—	22½	19½	17-1	36½	40½	87½
'20 ...	79½	32	22	38½	—	20½	18½	20-1	43½	71½	75
'21 ...	31½	11½	8½	26½	—	9½	8½	9-58	25½	46½	36½
'22 ...	39	17½	9½	28½	—	9½	9½	8-06	24½	36	34½
'23 ...	43½	20½	12	24½	—	9½	8½	8-23	23½	31½	36½
'24 ...	53½	25½	18½	23½	—	10½	8½	8-63	22½	33½	42½
'25 ...	41½	17½	17½	18½	—	11½	8½	9-87	23	33	42½
'26 ...	36½	16½	15	15½	—	10½	8	9-32	21½	35½	38½
'27 ...	38½	17½	15½	15½	—	12½	10½	9-85	22½	36½	33½
'28 ...	37	17½	17½	14	—	15½	11½	12-09	23½	37½	36½
'29 ...	35½	13½	16½	13½	—	10½	8½	10-80	19½	33½	36½
'30 ...	18½	8½	10½	10½	—	6½	6½	7-80	18½	33½	28½
'31 ...	14-7	7-1	8½	8½	—	5½	5½	6-12	17½	32½	19½
'32 ...	15-0	7-2	5½	8½	—	4½	4½	5-47	17½	28½	21½
'33 ...	19-9	9-3	5½	6½	—	5½	4½	5-65	17½	26½	19½
Average 1904-13	17½	9	10½	11½	—	9½	7½	6½	16	17	31½
1890-99	13½	6½	10	11½	—	6½	5½	5	13½	13½	25
'78-87	18½	8½	11½	15	—	8½	6½	6½	15	17	35½
'67-77	21½	9½	19½	23	—	9	7	6½	16	18½	45
Index-Numbers (or Percentages) of Prices, the Average of 1867-77 being 100.											
1873 ...	118	—	124	95	822	120	—	—	114	—	97
1913 ...	88	—	63	48	670	133	—	—	112	—	76
'14 ...	90	—	64	47	647	139	—	—	118	—	70
'15 ...	104	—	88	43	739	149	—	—	145	—	81
'16 ...	159	—	101	71	1,031	174	—	—	160	—	104
'17 ...	219	—	106	94	1,535	225	—	—	200	—	139
'18 ...	222	—	95	112	1,772	218	—	—	188	—	182
'19 ...	315	—	114	113	1,820	258	—	—	222	—	195
'20 ...	359	—	111	168	2,099	267	—	—	330	—	167
'21 ...	140	—	44	115	1,117	123	—	—	205	—	81
'22 ...	180	—	49	125	1,075	114	—	—	174	—	77
'23 ...	206	—	61	105	1,121	113	—	—	158	—	81
'24 ...	254	—	96	102	1,362	119	—	—	163	—	94
'25 ...	188	—	87	79	1,319	132	—	—	161	—	94
'26 ...	170	—	76	69	1,063	121	—	—	164	—	85
'27 ...	177	—	78	67	1,045	142	—	—	172	—	75
'28 ...	174	—	91	61	1,086	172	—	—	176	—	82
'29 ...	156	—	81	60	976	129	—	—	166	—	81
'30 ...	86	—	54	48	669	92	—	—	150	—	64
'31 ...	70	—	43	39	504	77	—	—	146	—	43
'32 ...	71	—	29	35	513	66	—	—	132	—	47
'33 ...	94	—	30	29	534	68	—	—	127	—	44

* Port Phillip fleece washed nominal since 1895, exactly in proportion with the value of clean wool.

† Common New Style from 1921.

Average Prices of Commodities—Contd.

No of Article	Year.	38	39	40A	40B	41	42	43	44	45A	45B	35-45	20-45	1-45
		Oil.		Steeds		Petro- leum *	Soda	Nitrate of Soda.	Indigo	Timber		Sundry Mate- rials.	Mate- rials	Grand Total.
		Palm	Olive	Lin- seed	Lin- seed	Re- fined	Crystals.		Bengal, Good Con- suming	Heav. Average Import Price	Sawn or Split, Average Import Price.	Total.	Total	
		£ per ton	£ per ton	£ per ton	s per qr.	d. per gall	£ per ton.	s per cwt	s per lb	£ per load.	£ per load.			
1873 ...	38	43	32	62	15½	100	15½	6½	65	62	—	—	—	
1913 ...	35½	49½	24½	45½	8½	47½	11½	2½	40	63	—	—	—	
'14 ...	37½	50½	24½	48½	7½	47½	10½	5½	41½	64½	—	—	—	
'15 ...	34½	51½	30½	57½	8½	48½	12½	13½	58½	94½	—	—	—	
'16 ...	44½	59½	41½	80½	12	78½	17½	13½	82½	148½	—	—	—	
'17 ...	46	115½	56½	112½	16½	89½	25	10½	97½	210	—	—	—	
'18 ...	44½	198½	63½	131½	21½	82½	27½	9	107½	271	—	—	—	
'19 ...	69½	200½	92½	139½	17½	118½	24½	9½	137½	232½	—	—	—	
'20 ...	69½	200½	88½	157	25½	150	24½	14½	119½	261½	—	—	—	
'21 ...	36½	80½	31½	72½	22½	140	18½	11½	68½	156½	—	—	—	
'22 ...	34½	75½	39½	75½	15½	123	14½	9½	46½	117½	—	—	—	
'23 ...	36½	66½	42½	77½	13	103	13½	7½	48	131½	—	—	—	
'24 ...	40½	79½	42½	81½	13½	101½	13½	6½	49½	122	—	—	—	
'25 ...	40½	73½	43½	80½	13½	100	13½	5½	47½	122½	—	—	—	
'26 ...	37½	79½	32½	63½	13	100	13½	5½	48½	107	—	—	—	
'27 ...	34½	102½	31½	64½	13	100	12½	5½	45½	107½	—	—	—	
'28 ...	35½	80½	29½	66½	11½	100	10½	5½	45½	111½	—	—	—	
'29 ...	34½	72	35½	74½	12½	100	10½	5½	44½	107½	—	—	—	
'30 ...	25½	52½	36½	61½	12½	100	9½	5½	44½	102½	—	—	—	
'31 ...	19½	53½	18½	38½	11½	100	9½	5½	37½	83½	—	—	—	
'32 ...	17½	57½	17	38½	10½	100	8	5½	35½	75½	—	—	—	
'33 ...	15½	53½	20½	39½	10½	100	8½	5½	31½	75½	—	—	—	
Average														
1904-13	31½	43½	26½	49½	6½	60	10½	3	38	56	—	—	—	
1890-99	24½	35	19½	38	5½	53	8½	4½	40	45	—	—	—	
'78-87	32½	40	23	46	6½	62	12½	6	47	47	—	—	—	
'67-77	39	50	30	60	12½*	92	14	7½	60	54	—	—	—	
Index-Numbers (or Percentages) of Prices, the Average of 1867-77 being 100														
1873 ...	97	86	105	122	109	110	92	111	1,163	2,974	5,011			
1913 ...	90	99	78	68	52	82	38	90	918	2,363	3,826			
'14 ...	84	101	82	61	52	78	80	93	958	2,298	3,832			
'15 ...	89	104	97	71	53	90	184	134	1,197	2,816	4,844			
'16 ...	114	119	135	96	86	128	183	202	1,501	3,641	6,117			
'17 ...	118	231	187	129	98	178	142	270	1,917	4,655	7,866			
'18 ...	115	396	216	170	90	194	124	332	2,225	5,344	8,651			
'19 ...	178	400	258	138	128	177	126	325	2,405	5,763	9,278			
'20 ...	179	400	272	203	164	177	200	335	2,684	6,851	11,298			
'21 ...	95	160	116	177	152	135	158	198	1,600	3,985	6,991			
'22 ...	89	151	127	122	134	102	128	143	1,361	3,430	5,895			
'23 ...	93	133	134	104	112	96	103	157	1,284	3,488	5,806			
'24 ...	103	160	138	105	111	97	84	151	1,325	3,792	6,267			
'25 ...	104	147	137	105	109	96	79	150	1,314	3,713	6,142			
'26 ...	96	159	106	104	109	95	78	137	1,254	3,395	5,662			
'27 ...	88	205	107	104	109	90	76	134	1,302	3,337	5,503			
'28 ...	92	161	108	94	109	78	76	138	1,286	3,232	5,396			
'29 ...	89	144	122	102	109	73	76	134	1,225	3,082	5,178			
'30 ...	65	104	110	102	109	70	76	129	1,071	2,524	4,350			
'31 ...	51	108	63	90	109	65	76	106	934	2,138	3,717			
'32 ...	45	114	61	84	109	62	76	97	893	2,100	3,609			
'33 ...	40	108	67	82	109	60	76	94	875	2,159	3,567			

* Petroleum average, 1873-77.

† Nominal.

Index of Silver Prices.

The base of the index-numbers given below is 1 gold to 15½ silver = 100.*

	Price per oz. standard.	Index- number.		Price per oz. standard.	Index- number.
	<i>d.</i>			<i>d.</i>	
Average 1873 ...	59½	=97·4	<i>Lowest Nov., 1902</i>	21½	=35·6
" '90-99...	34	=55·8	End Dec., 1906 ...	32½	=53·1
" 1917-26...	40½	=66·6	" Dec., '08 ...	23½	=38·1
" 1893 ...	35½	=58·6	" Dec., '11 ...	25½	=41·2
" '96 ...	30½	=50·5	" Dec., '12 ...	29	=47·7
" 1909 ...	23½	=38·9	" Dec., '13 ...	26½	=43·7
" '13 ...	27½	=45·3	" June, '14 ...	26	=42·7
" '14 ...	25½	=41·6	" Dec., '14 ...	22½	=37·3
" '15 ...	23½	=38·9	" Dec., '15 ...	26½	=43·1
" '16 ...	31½	=50·4	" Dec., '16 ...	36½	=58·7
" '17 ...	40½	=65·8	" Dec., '17 ...	43½	=70·0
" '18 ...	47½	=76·4	" Dec., '18 ...	48½	=77·9
" '19 ...	57	=85·3	" Dec., '19 ...	77½	=98·3
" '20 ...	61½	=76·1	" Dec., '20 ...	40½	=49·2
" '21 ...	36½	=48·1	" Dec., '21 ...	34½	=49·3
" '22 ...	34½	=51·6	" Dec., '22 ...	31½	=49·6
" '23 ...	31½	=49·4	" Dec., '23 ...	33½	=49·0
" '24 ...	34	=50·7	" Dec., '24 ...	31½	=50·4
" '25 ...	32½	=52·5	" Dec., '25 ...	31½	=52·1
" '26 ...	28½	=47·1	" Dec., '26 ...	25	=41·1
" '27 ...	26½	=42·8	" Dec., '27 ...	26½	=43·6
" '28 ...	26½	=44·0	" Dec., '28 ...	26½	=43·3
" '29 ...	24½	=40·2	" Dec., '29 ...	21½	=35·2
" '30 ...	17½	=29·0	" Dec., '30 ...	14½	=23·7
" '31 ...	14½	=20·4	" Dec., '31 ...	20½	=21·6
" '32 ...	17½	=19·5	" Dec., '32 ...	16½	=17·2
" '33 ...	18½	=18·7	" Dec., '33 ...	19½	=19·5

* All the index-numbers in the table from 1916 to 1925 inclusive are calculated on the basis of the gold prices of silver instead of the sterling prices, though the latter are the quotations given in the table and are used for 1931-33. In arriving at the index-numbers the price of gold during 1916, 1917 and 1918 is taken as 86s. 9½d. per fine oz., derived from the "pegged" New York rate of \$4·76½ to the £. For 1919 the average price of gold is taken as 93s. 4½d., this being the parity price with the U.S. dollar, the average New York exchange in that year being \$4·429. The index-numbers for other dates are based on the quotations in the London market for exportable gold. The average price in 1920 was 112s. 11½d. per fine oz., in 1921 107s. 0½d., in 1922 93s. 4d., in 1923 90s. 3d., in 1924 93s. 8½d., and in 1925 85s. 5½d. At the end of 1919 the quotation was 109s. 8½d., at the end of 1920 116s. 1d., at the end of 1921 98s. 0d., at the end of 1922 88s. 11d., at the end of 1923 95s. 4d., and at the end of 1924 88s. 2d. At the end of 1931 the price of gold was 121s. 11d., and at the end of 1932 123s. 9d. The average price in 1931 was 92s. 6·23d., and in 1932 118s. 0·82d. The average price in 1933 was 124s. 10·40d., and at the end of 1933 126s. 2·62d.

World's Production of Silver (in millions of ounces).

	United States.	Mexico.	Canada.	Australia.	Other Countries.	Total.
1901... ..	55·2	57·6	5·2	10·2	44·8	173·0
'02... ..	55·5	60·2	4·3	8·0	34·8	162·8
'03... ..	54·3	70·5	3·1	9·7	30·1	167·7
'04... ..	57·7	60·8	3·7	14·5	27·5	164·2
'05... ..	56·1	65·0	5·9	15·0	30·3	172·3
'06... ..	56·5	55·2	8·5	14·2	30·6	165·0
'07... ..	56·5	61·0	12·8	19·0	34·8	184·2
'08... ..	52·4	73·6	22·1	17·2	37·8	203·1
'09... ..	54·7	73·9	27·5	16·3	39·7	212·1
'10... ..	57·1	71·4	32·9	21·5	38·8	221·7
'11... ..	60·4	79·0	32·7	16·6	37·5	226·2
'12... ..	63·8	74·6	31·6	18·1	36·2	224·3
'13... ..	66·8	70·7	31·5	3·5	51·4	223·9
'14... ..	72·4	27·5	28·4	3·6	36·3	168·4
'15... ..	74·9	39·5	28·4	4·1	37·3	184·2
'16... ..	74·4	38·2	25·4	4·2	26·6	168·8
'17... ..	71·7	35·0	22·2	10·0	35·3	174·2
'18... ..	67·8	62·5	21·2	10·0	35·9	197·4
'19... ..	56·7	62·7	15·7	7·4	32·0	174·5
'20... ..	55·5	66·8	12·6	7·5	33·0	175·4
'21... ..	53·1	64·5	13·1	4·9	35·7	171·3
'22... ..	56·2	81·1	18·6	11·3	46·3	213·5
'23... ..	73·3	90·9	17·8	10·3	50·2	242·5
'24... ..	65·3	91·5	19·7	10·8	52·2	239·5
'25... ..	66·1	92·9	20·2	11·1	54·8	245·1
'26... ..	62·7	98·3	22·4	11·2	59·0	253·6
'27... ..	60·4	104·6	22·7	9·0	57·3	254·0
'28... ..	58·4	108·5	21·9	9·0	59·5	257·3
'29... ..	61·2	108·7	23·1	9·0	59·7	261·7
'30... ..	51·0	105·0	26·0	8·9	57·1	248·0
'31... ..	31·0	86·0	21·0	7·6	47·4	196·0
'32... ..	24·0	69·0	18·0	6·5	47·5	165·0
'33* ..	22·0	69·0	15·0	7·6	49·4	163·0

* Provisional.

Gold.—The following table shows the world's annual gold production since 1850. Prior to 1911 the estimates are those of the Bureau of the U.S. Mint and other authorities. The value is taken throughout at £4.25 per fine oz. The estimate for 1933 is subject to revision.

(000's omitted.)

Year.	Value of output. £	Year.	Value of output. £
1850	11,600	1892	30,134
'51	17,200	'93	32,363
'52	26,550	'94	37,229
'53	31,090	'95	40,843
'54	25,490	'96	41,559
'55	27,015	'97	48,509
'56	29,520	'98	58,949
'57	26,655	'99	63,027
'58	24,930	1900	52,312
'59	24,970	'01	53,630
'60	23,850	'02	60,975
'61	22,760	'03	67,337
'62	21,550	'04	71,380
'63	21,390	'05	78,143
'64	22,600	'06	82,707
'65	24,040	'07	84,857
'66	24,220	'08	90,995
'67	22,805	'09	93,302
'68	21,945	'10	93,544
'69	21,245	'11	94,930
'70	21,370	'12	95,783
'71	25,400	'13	97,461
'72	24,200	'14	92,709
'73	23,600	'15	97,114
'74	22,950	'16	92,597
'75	22,700	'17	87,236
'76	22,540	'18	78,605
'77	23,830	'19	73,078
'78	22,020	'20	68,522
'79	21,400	'21	67,848
'80	22,130	'22	66,723
'81	21,150	'23	77,888
'82	20,500	'24	81,807
'83	20,640	'25	82,267
'84	20,830	'26	82,211
'85	21,250	'27	82,582
'86	21,430	'28	83,961
'87	21,735	'29	82,862
'88	22,644	'30	88,500
'89	25,375	'31	94,300
'90	24,421	'32	102,500
'91	26,846	'33	102,000

MISCELLANEA.

IMPROVEMENT OF CURVES FITTED BY THE METHOD OF MOMENTS.

By W. PALIN ELDERTON, C.B.E., F.I.A., and G. H. HANSMANN, Ph.D.

THE article by Mr. Koshal on p. 303 of the *Journal* (vol. xcvi, 1933) gives an interesting application of Fisher's method of maximum likelihood to a statistical example. Mr. Koshal fitted a Pearson Type I curve to the statistics by moments and then, by calculating "likelihood" functions, modified the values of the various parameters and obtained a better fit.

Mr. Koshal was, of course, only concerned with the example chosen as material for illustrating a method, but the fact that from the nature of the example, the fibre-strength of 1,000 cotton fibres, at least one condition is imposed on the frequency function *a priori*—there can be no *negative* strength classes—it may be of interest to point out that, in such cases, as good or better fits can be obtained with less arithmetic, by taking advantage of considerations pointed out by one of us more than twenty-five years ago (see *Frequency Curves and Correlation*, 2nd edition, pp. 121–122). In this note we employ the notation of that text-book.

We first calculated the moments without any adjustment and found the following figures:—

Mean 0.588 after mid-point of base of frequency 159

μ_2 5.526

μ_3 10.280

μ_4 98.390

β_1 0.6262

β_2 3.2217

α_1 1.8986

α_2 13.415

m_1 0.579

m_2 4.091

Mode 0.861 after mid-point of base of frequency 165

range 15.314

(The last decimals are unreliable.)

The result does not agree with that given by Mr. Koshal possibly because he adjusted the moments, but he does not state how. We did not calculate y_0 , but seeing from the calculated start of the curve that there should have been some adjustment of the crude moment

in respect of the first group, we assumed that the curve started at a point half a normal base * before the beginning of the second group and calculated the moments about this point (i.e. the start of the curve), assuming that the frequency of 38 was concentrated at the middle point of the base now assumed for it.†

The figures set out above show that the total range is a little over 15 intervals and, with m_2 relatively large compared with m_1 , the assumption of 16 for the total range should be reasonably accurate and by avoiding a third moment would save a certain amount of work.

The arithmetical work is given almost completely as follows :—

Frequency.	Assumed distance from assumed start of curve.	Calculations for	
		first moment.	second moment.
38	0.25	10	2
165	1	165	165
188	2	376	752
159	3	477	1,431
137	4	548	2,192
114	5	570	2,850
81	6	486	2,916
48	7	336	2,352
29	8	232	1,856
19	9	171	1,539
15	10	150	1,500
7	11	77	847
1000		3,598	18,402

Using the moments about the start of the curve with the formulæ given on pp. 120–121 paragraph 8 of *Frequency Curves and Correlation*, we have—

$$\mu_1' \quad 3.598$$

$$\mu_2' \quad 18.402$$

$$b \quad 16.000$$

$$m_1 \quad 0.61415$$

$$m_2 \quad 4.56383$$

$$a_1 \quad 1.8977$$

$$a_2 \quad 14.1023$$

and writing the curve as $y = y_0 x^{m_1} (b - x)^{m_2}$

$$\log y_0 \quad 4.84850$$

* The "half" was chosen as an approximation lending itself to simple calculations.

† If the statistics are correctly described, the base of the first group is 0.95 and that of subsequent groups unity. This was ignored in the first crude moments and may account partly for our figures not agreeing with those of Mr. Koshal.

Using these values to fit the curve the graduation set out in the table below was obtained.

Observed frequency.	Type I. Frequency fitted by	
	This paper.	Koshal "Maximum Likelihood."
38	41.05	42.06
165	160.53	154.94
188	182.33	181.50
159	167.50	168.80
137	139.02	140.77
114	107.37	108.76
81	77.87	78.65
48	53.01	53.32
29	33.69	33.68
19	19.76	19.66
15	10.48	10.40
7	7.39	7.46
	(χ^2 4.65)	(χ^2 5.54)

The table includes the figures given by Mr. Koshal for his graduation and shows the total for χ^2 . The comparison of the totals and the items that go to make them up shows that in the particular case a closer graduation has been obtained than that given by Mr. Koshal and with less work. But both the graduations are good and there is little to choose between them. Some of the differences may be due to such adjustment of the moments as Mr. Koshal may have made.

This note is intended neither as an expression of an opinion as to the practical value of the method of maximum likelihood nor of Mr. Koshal's approximate method, which is of interest quite apart from the numerical example, but merely to show how improved graduations may be obtained by simple methods already in use.

If we have to make a graduation by such a curve as Pearson's Type I we cannot usually afford to spend on arithmetical processes the time required by Mr. Koshal's methods and we must be content with some practical alternative. Judging by this example (and others tried previously) there seems little objection from the arithmetical point of view to the method of moments modified in the way shown or in other simple ways that experience suggests.

REVIEWS OF STATISTICAL AND ECONOMIC BOOKS.

CONTENTS.

	PAGE		PAGE
1.— <i>Andersson (Walter)</i> . Researches into the Theory of Regression	334	8.— <i>Cole (G. D. H.)</i> . Studies in World Economics	346
2.— <i>Kuczynski (R. R.)</i> . Fertility and Reproduction ...	336	9.— <i>Plummer (Alfred)</i> . International Combines in Modern Industry	348
3.— <i>Rhodes (E. C.)</i> . Elementary Statistical Methods ...	337	10.—International Labour Office. Industrial Relations in Great Britain	349
4.— <i>Aftalion (Albert)</i> . L'Or et sa Distribution Mondiale ...	338	11.— <i>Elbourne (E. T.)</i> . Fundamentals of Industrial Administration	350
5.— <i>Gregory (T. E.)</i> . Gold, Unemployment, and Capitalism	342	12.— <i>Windett (Nancy)</i> . Australia as Producer and Trader, 1920-1932	351
6.— <i>Robbins (Lionel)</i> . Nature and Significance of Economic Science	343	13.—Other new publications ...	353
7.— <i>Hodson (H. F.)</i> . Economics of a Changing World ...	345		

1.—*Researches into the Theory of Regression*. By Walter Andersson. Lunds Universitets Årsskrift. N.F. Nr 1. (1932.) 10½" × 7½". 216 pp.

"The subject of these researches" (to quote the author's own words) "is to treat—from a practical point of view as completely as possible—the problem of describing the bi-variate regression by means of parabolas of suitable orders fitted in accordance with the principle of least squares."

Appreciating the importance of being able to fit a regression parabola term by term up to the order found necessary, the author considers the orthogonal polynomial method of graduation investigated by Tchebycheff and others, works out the general solution of the normal equations, and finds the standard errors of the regression coefficients under various assumptions.

The theory of statistical regression is approached here from the standpoint of our data being interpreted as a random sample from a bi-variate population. In an attempt to overcome the apparent difficulty of the enormous sampling errors attributable to the higher moments when we are fitting curves of reasonably high order, the method advocated is to calculate these moments in a semi-theoretical way by assuming some theoretical distribution corresponding to the population. In particular, this method is studied when the marginal distribution of the independent variate is assumed to be some

theoretical form—normal, Charlier's Type A, Pearsonian, Poisson exponential, and logarithmical normal. Many examples are given illustrating these methods.

It does not appear likely that this paper will modify existing methods of fitting regression lines, for it seems based on principles which have become somewhat out-of-date. The approach by way of a population of two correlated variates is often extremely artificial when curvilinear regression is present. It is difficult, for example, to see any value in knowing the mean square errors—on the assumption of the normal correlation function, which implies linear regression—of regression coefficients of order higher than the first (see Chapter 2).

The only mention of the exact theory given by Fisher (*J.R.S.S.* 85 (1922), pp. 597–612) for the distribution of regression coefficients on the assumption of a dependent variate normally distributed with the same variance for each value of the independent variate—the natural assumption since we are using the theory of least squares—is in a footnote on p. 58. It is true that the author seems primarily concerned with very large samples, and it is sufficient to consider standard errors, but he has not perceived that by leaving the actual values observed in the sample for the independent variate in the expressions for these standard errors, that is, regarding the values as fixed, the standard errors are obtainable without any assumption as to the distribution of the independent variate, and the errors of the higher moments of this variate for repeated sampling subject to this condition will be zero. It might perhaps also be asked what advantage fitting a regression parabola of the third or fourth order to a sample size 1,081,655 (Table VII, p. 74) has over a simple process which in a sample of this size presumably gives a smooth enough curve—that of joining up the means of arrays.

The statement (p. 33) that when fitting a polynomial we are to stop directly the coefficients are insignificant may be misleading, for it is always advisable to try the effect of the next term if the last is insignificant, since one term will represent an odd, the other an even function.

Fitting polynomials of much higher order than the third is admittedly a matter for caution. This is not, however, because of the large sampling errors of the moments of the independent variate (which the author, following earlier writers, finds such a great stumbling-block), but because the rapid change in the value of the polynomial at the extreme ends of the range indicates that seldom can it really represent the regression or trend. Theoretically, we may expect to fit a polynomial of the 6th degree to a sample of 50 as accurately as a straight line to a sample of 45.

There is, of course, in the case of large samples of a continuous independent variate the difficulty about grouping, but if the grouping is reasonably fine and the regression never too steep, this is not likely to lead to much error. We may then fit our regression curve to the weighted means of the arrays term by term. The simplified orthogonal method for the case of unweighted equi-distant data is not easily extended, and it is better to proceed on lines really indicated by

Gauss's original method of solution of normal equations; an improved systematic method of solution recently invented by Aitken is available for fitting our polynomial (see *Proc. Roy. Soc. Edin.* 54 (1933), pp. 1-11).

The assumptions necessary for the straightforward use indicated above of the theory of least squares are certainly not always true, but they are less arbitrary and much more general than those considered by the author; one therefore feels in a paper of this magnitude that a far more critical examination was needed of the principles underlying the calculation of regression coefficients and the interpretation of their standard errors.

M. S. BA.

2.—*Fertility and Reproduction. Methods of measuring the balance of births and deaths.* By R. R. Kuczynski. New York: Falcon Press, 1932. 9" × 6". 94 pp. 8s. 6d.

The subsidiary title of this book recalls another by the same author, reviewed in this *Journal* in 1929 (Vol. 92, p. 271), the theoretical part of which was devoted to an exposition of methods of calculating fertility rates. The present book, in part at least, covers the same ground. The standpoint taken up is that the methods commonly used in analysing vital statistics are quite inadequate for the purpose, many people believing that fertility can be measured by the birth-rate and vitality by relating the number of births to the number of deaths. It is, however, generally recognized that crude birth-rates are not a satisfactory measure of fertility, and methods have long been in existence for dealing with the changing nature of the population. This book is intended to serve as an introduction to the methods of measuring fertility and reproduction, and as an elementary treatise on the subject it serves a useful purpose. Birth-rates and fertility rates are discussed in Chapter 1, and the method described of calculating specific fertility rates by age groups. The author then shows how total fertility should be calculated, and from it a measure of the gross reproduction rate, a figure with which to measure fertility which has, however, its limitations. In Chapter 3, after stating that the difference between the birth and death rates is an inadequate measure of net reproduction, the author shows how to calculate the reduction of total fertility by mortality through the use of life tables, and finally how to obtain a net reproduction rate. The fourth chapter deals with the rate of increase and the birth-rate of a stable population, and with a short chapter on the reproduction rate for both sexes the book proper is at an end on p. 38. It is a favourite plan, however, with the author to add appendices rather longer than the main text, and the remaining 56 pages are for the most part taken up with an amplification of Chapter 4. An account is given of the work of Bortkiewicz, and some discussion follows of the paper by Dublin and Lotka "On the true rate of natural increase," with comments by the author and a numerical test of the results. In so far as this is controversial it need not concern a reviewer, but we may at least agree with the remark of the author that the methods of Dublin and Lotka are of great scientific value.

J. W.

3.—*Elementary Statistical Methods*. By E. C. Rhodes. London : Routledge, 1933. $8\frac{1}{2}'' \times 5\frac{1}{2}''$. 243 pp. 7s. 6d.

This is the first number to appear of a series of Studies in Statistics and Scientific Method, issued by the London School of Economics and Political Science, and edited by Professors A. L. Bowley and A. Wolf. The volume before us is a guarantee that the needs of students, even the most elementary, will be met with great thoroughness. Dr. Rhodes has succeeded in producing an excellent manual as a first study for students of statistics. The treatment is designedly elementary, but although he claims that only the simplest methods are considered, there is little in the way of technique required by the collector and tabulator of statistical data that does not find a place. No attempt, it is stated, is made to deal with that branch of statistics which involves probability or elaborate mathematical analysis. There are those who deal with advanced mathematical statistics to the exclusion of all else. Such are apt to lose sight of the purposes to which their formulæ are to be put; namely, the reduction of data collected by observation. It is clear that no theory, however mathematical, will make up for a lack of appreciation of the exact purpose the figures are designed to serve, or for carelessness and inaccuracy in the collection of the basic data. So it is not only the beginner who will profit by a perusal of this book.

The advanced worker will do well to study it carefully to remind himself of all the points that have to be thought of and dealt with before the raw material of statistics is in a sufficiently finished state to be amenable to ultra-refined methods, or even to be worth dealing with at all. On the other hand, the beginner could find no better medium of introduction to the basic requirements of his science.

Beginning with the functions of the statistician and the nature of statistical enquiries, the author goes on to consider the assembling of statistical data, and the process of getting, by means of the methods of statistics, those secondary or derived statistics which are used to present the results of the primary investigation which has been undertaken. The statistical table, the diagram and the graph are described in detail, with a wealth of illustrations taken mainly from economic sources. The processes dealt with comprise the comparison and calculation of averages, unweighted and weighted, the various measures of dispersion, the calculation and use of index-numbers and methods of analysis appropriate to time series. This last hardly gets beyond the stage of calculating moving averages, so that even here there is nothing to conflict with the description of the book as elementary.

Dr. Rhodes has a good style, and, as befits a teacher of experience, he introduces one idea at a time. At various points the reviewer has caught himself noting down points unmade, only to find invariably that these points came up later as part of a logical sequence of ideas, and in the right place. Two slips only have been noticed, an arithmetical one on p. 54 and a misprint on p. 212. So much is said about frequency series, and the errors of estimate that arise

through assuming the individuals in a class to be concentrated at the centre of that class, and so on, that perhaps a word or two might have been added about skewness. Thus the errors in estimates on p. 87 are dismissed with the remark that some are positive and some negative. In fact, those for groups below the mean are systematically negative, while the others are positive. The enquiring student may well find something here that is not explained. But it is easy to say what might be added, granted the desirability of increasing the size of the book. What is clear is that no space has been wasted, and we have here an attractive book, at an attractive price, of a character that will convince the student that up to the point which it professes to reach it is authoritative and comprehensive.

J. W.

4.—*L'Or et sa Distribution Mondiale*. By Professor Albert Aftalion. Paris: Librairie Dalloz, 1932. 9" × 5½". viii + 235 pp. 25 fr.

This book is primarily a criticism of the classical doctrine of equilibrium in the international distribution of gold. According to the classical doctrine an excess or a shortage of gold in any country will induce a rise or fall of the price level, and the consequent excess of imports or of exports will rectify the gold position.

Professor Aftalion shows that in the United States the imports of gold from 1921 to 1927 did not cause a rise of prices or an excess of imports, and he argues that there was no "sterilization" of gold, since bank deposits expanded more than in proportion.

Likewise in France in the years 1927-31 the importations of gold to the amount of 34 milliards were accompanied by an increase of 27½ milliards in the note issue, and a large increase in bank deposits. "There was no sterilization of gold since the quantity of the means of payment placed at the disposal of the public was probably not less than the quantity of gold imported" (p. 31).

Professor Aftalion concludes that the classical doctrine is at fault in that it assumes the price level to depend only on the quantity of money, without taking velocity of circulation into consideration (p. 33).

Where in the Dark Ages has he dug up this "classical" doctrine? Even if he resents the glib superficialities of newspaper-men and politicians, he need not impute their fallacies either to the classical economists or to the present-day exponents of their teaching. The classical doctrine of the distribution of gold has never left out of account the disturbing factors such as changes in the velocity of circulation.

Professor Aftalion points out that "in the cyclical periods of prosperity prices rise more than in proportion to the quantity of money. An acceleration of the rapidity of circulation makes good the deficiency of quantity" (p. 174).

"In France," he says, "from February, 1922, to February, 1924, it was possible for prices to rise 78 per cent. at a time when the monetary circulation increased only 8 per cent., notwithstanding a noticeable expansion in the volume of transactions. Increased

velocity of circulation provided the means of dealing with greatly increased payments " (p. 173).

But when he has to explain the increase in the French note issue from 52 milliards at the beginning of 1927 to 79 milliards in 1931, he forgets this previous phase. The gold value of the note issue of 78,947 millions of francs in February, 1931, was actually *less* than that of the 36,151 millions in circulation in February, 1922.

He attributes the increase in the note issue from 1927 to 1931 to "hoarding." Undoubtedly in 1931, when Professor Aftalion was writing, hoarding had begun. But that was *after* the harm had been done. In the first instance the expansion of the French monetary circulation had been due not to any exceptional hoarding, but to the simple fact that with a twopenny franc and the world price level of 1926-29 the monetary practices of the French people *required* a note issue of 75 to 80 milliards. In 1913 with a national income of 35 milliards the monetary circulation was 11 milliards, or nearly four months' income. There was no reason to suppose that in 1929 with a national income of 250 milliards a smaller proportion would suffice.

"If," says Professor Aftalion, "it is true that the spontaneous movements of gold are towards the countries where gold has its highest value, that law must be given a different interpretation from that of the old economists. . . . Gold is sent where it commands the best price in money, rather than where it buys the most products. Its movements depend on the variations of the rate of exchange rather than on those of the prices of goods" (p. 35).

"Gold responding to differences in rates of exchange rather than to differences in prices, and some countries, such as the United States and France, having for several years enjoyed a favourable exchange, the great importations of gold into those countries are explained" (p. 41).

This is to correct Ricardo by calling in the seventeenth century to redress the balance of the nineteenth! Ricardo's theories were in many respects imperfect and crude, but at any rate he realized that a favourable exchange or a favourable balance of payments supplied no *explanation* of a movement of gold. The classical doctrine sets out to explain how a monetary disequilibrium will *cause* a disturbance of the balance of payments and a departure of rates of exchange from parity, and further how the resulting movements of gold tend to restore equilibrium.

France in 1927 had an insufficient monetary circulation. To make good the deficiency, the individuals whose cash resources were inadequate were impelled to accumulate cash in preference to buying goods or securities. The result of this restriction of expenditure and of investment was a favourable balance of payments and an importation first of foreign exchange and then of gold, till the shortage of currency was remedied. There is nothing here inconsistent with the classical doctrine. The combination of an extreme shortage of currency with a vigorously deflationary turn of monetary policy is an exceptional occurrence; it involves a bigger movement of gold to restore equilibrium than any ordinary disturbance. Under such conditions the inflow of gold fails to induce a rise of prices in the

recipient country, and its effect is felt entirely in the fall of prices elsewhere. If the recipient country is important enough, the effect on the world value of gold may be catastrophic.

"How," asks Professor Aftalion, "can the crisis be explained by a deficiency of gold, when it is of such intensity, of such all-pervasive power, in the United States where there is such a profusion of gold?" If there were a great increase in the demand for pearls in certain countries, say, France and the United States, would he argue that the rise in the value of pearls could not be due to the reduced supply in the rest of the world, because it was just as great in those countries where there was an increased supply? The value of gold may be raised by an increased demand from any quarter as readily as the value of pearls. The deficiency of currency in France created a new demand for gold to the amount of £250,000,000.

Professor Aftalion protests that "the policy of the Bank of France has not been responsible for the importations of gold into France since the middle of 1929, and for the accentuation of the world disequilibrium of gold which has resulted. The Bank does no more than apply the rules of the gold standard and has not the right to refuse the metal brought to it" (p. 99). But he does not think it necessary, in the course of his apologetics, to mention that the Bank of France is precluded from buying securities in the open market, so that, in view of the very limited supply of eligible bills, an expansion of the currency *cannot* be effected except by the deposit of gold. Other countries do not need so vast a gold holding as France, partly because those of comparable wealth and economic development do not hold so great a proportion of their cash in the form of currency, but partly also because central banks have a greater freedom in the provision of backing for their note issues. This limitation of the freedom of the Bank of France is imposed not by Divine ordinance but by the French legislature.

Professor Aftalion cites facts to prove "the great variability of velocity of circulation. They support the inference that even if (as is not proved) the accumulation of gold in France and the United States between 1926 and 1929 caused a restriction of monetary circulation in the world, the fall of prices would not have been inevitable" (p. 175). He treats the variations of velocity as a compensating factor that might have been expected to mitigate the deflationary effects of the absorption of gold. But variations of velocity, far from being a compensating factor, tend to *aggravate* the consequences either of inflation or of deflation. Velocity increases at times of activity and decreases at times of depression. The deflationary measures induced in London and elsewhere by the French absorption of gold (the United States on balance absorbed none between 1926 and 1929) tended themselves to *retard* the velocity of circulation.

In one respect Professor Aftalion has something to contribute to the amendment of the classical doctrine. He supports the "income theory of money," and maintains that the efficacy of gold movements in bringing about equilibrium depends upon their effect in expanding incomes in the countries which gain gold and contracting incomes in

those which lose it. In fact the price movements may be regarded as *symptoms* of more fundamental variations in incomes, and the classical doctrine requires to be restated in terms of incomes. It is an expansion of incomes that induces an unfavourable balance of payments, a contraction of incomes that induces a favourable balance.

Unfortunately, Professor Aftalion does not, either in this book or in his earlier works, pursue the application of the income theory of money to its conclusion. He assumes a false antithesis between the quantity theory of money and the income theory. The two are perfectly consistent with one another and are linked together by what Professor Pigou calls the "income velocity" of money. Professor Aftalion also fails to recognize the direct connection between credit regulation and the enlargement or compression of incomes, a connection which does not have to operate through an expansion or contraction of the quantity of money or of bank credit.

He shows how an increased output of gold may bring about an expansion of incomes and therefore a rise of prices throughout the world, but he is unwilling to admit that a shortage of gold may bring about a contraction of incomes and a fall of prices. Rather, in his view, a shortage of gold leaves the way open to *other* factors making for a fall of prices. "Those factors consist principally in the persistent efforts to reduce costs and increase production, which are found in the various countries of the world" (p. 183).

"The force of the factors making for a fall of prices and the absence of any compensatory action arising from a great increase in the production of gold seem adequately to account for the prolonged decline of prices since 1920" (p. 184).

Is it by a reduction of costs and increase of productivity that we are to account for the fall of prices in the United States from an index of 247 in May, 1920, to one of 86 in March, 1933? If so, why was not industry as remunerative in March, 1933, as in May, 1920? Why did the profits of Corporations assessed to income tax, from \$9,412 million in 1919, and \$8,740 million in 1929, become *minus* \$4,600 million in 1932?

If the fall of prices had been due to non-monetary causes there need have been no depression; business would have been profitable and industry fully employed.

After all his special pleading, Professor Aftalion frankly recognizes that a better distribution of gold is desirable, and that "many people in the countries rich in gold consider the excess to present more inconvenience than utility" (p. 198). The pride of the French in their gigantic gold holding is "a costly pride." Any excess of gold over what is required as cover for the note issue is a luxury, a sumptuary expense.

For a remedy he would rely mainly on improved facilities in France for external investment. But what is to be hoped from that? Gold *cannot* be released unless either the country will content itself with a smaller supply of currency (including deposits at the Bank of France) or the Bank of France will hold a smaller proportion of gold against its liabilities.

R. G. H.

5.—*Gold, Unemployment and Capitalism*. By T. E. Gregory, D.Sc. (Econ.), Sir Ernest Cassel Professor of Economics in the University of London. London: P. S. King & Son, 1933. 8½" × 5½". xvi + 308 pp. 12s.

This book is not, as perhaps the title may suggest, a discussion of the influence of monetary policy and capitalism on unemployment, but a collection of eighteen unconnected essays and addresses which have all been previously published and which fall roughly under the headings named. Dr. Gregory begins his preface with an apology for reprinting these papers, but since he says that "a well-established tradition dictates" such an attitude, it rather suggests that he is not whole-heartedly and spontaneously convinced of the necessity. If that is so, his readers will agree with him. The general level of the articles is not such as to demand any apology whatever. Collections of essays reprinted from a variety of journals, as these are, do frequently suffer from the fact that they were originally intended not for the specialist but for a less well-informed public; because they do not in such cases go down to the roots of things, they cease to have any value as soon as they are no longer wholly topical. There is very little in Dr. Gregory's book against which such a charge could be made. The problems he deals with are important enough and his theoretical discussions fundamental enough to give these essays a value to the economist which will probably remain even after the particular conditions they survey have ceased to be. That time, however, is not yet come. With the exception of the one historical essay, the contents of the book have all been written within the last eight years and the final answers to the economic questions raised during this period have—as we all know to our cost—not yet been reached. A volume such as this cannot, of course, shed any new light on the issues involved. Dr. Gregory's views are already known and probably there are few readers of this review who are not familiar with one or other of the papers included. Nevertheless, though no new line of thought is opened out, the collection under one cover of such solid and well-considered work is unquestionably worth while.

The standard of the essays necessarily varies. From a permanent standpoint, the two most important are probably the report submitted to the Gold Delegation of the League of Nations on the Causes of Gold Movements into and out of Great Britain (1931), and Dr. Gregory's addendum to the Macmillan report. The two surveys of American banking conditions, especially that on the Present Position of Banking in America (1925), are so packed with knowledge and fact that they will be invaluable to anyone whose particular interests lie on these lines. There are also papers which contain plenty of common sense on the pound and the gold standard, on questions of rationalization and on problems connected with the balance of trade and the deliberately achieved or enforced decline in the world volume of foreign trade. Of more specialized interest are the Observations on the Central Reserve Bank Bill (Australia) and the discussion of economic theories of employment during the Restoration period (1660–1713). The weakest essays are the two final ones which alone justify the in-

clusion of the term capitalism in the title and the address delivered at Adelaide on Current Problems in International Finance. This last is the type of reprint which might call for an apology. It raises a doubt whether Dr. Gregory was quite guiltless of talking down to a colonial audience.

From the reviewer's point of view it is fortunate that Dr. Gregory's general attitude is sufficiently well known to make the difficult task of summarizing it from such various material quite unnecessary. Reading this collection one is left with a general impression of a writer who refuses to be swept off his feet or to allow his judgment to be swayed by the enthusiasms of any one school of thought, but prefers to select and link together the elements of truth which he sees in various theories.

W. A. E.

6.—*An Essay on the Nature and Significance of Economic Science.* By Lionel Robbins, Professor of Economics in the University of London. London: Macmillan, 1932. 8 $\frac{3}{4}$ " \times 5 $\frac{1}{2}$ ". xii + 141 pp. 7s. 6d.

Professor Robbins finds few economists, except perhaps those of the latest Austrian school, with whom he can be in agreement, but that does not entitle him to use such phrases as "Ruskin and Carlyle and such-like critics," "poor Carlyle," "the incredible banalities of much of the so-called theory of production," and Marshall's "spineless platitudes about manures." The writer who uses such phrases runs the risk of being suspected of immaturity and damages his case by evoking irritation. Natural irritation should not, however, in this case cause the reader to close the book prematurely, for there is good matter in it, which will repay careful consideration.

Professor Robbins considers the definition of economics as "the study of the causes of material welfare" to be too narrow, and prefers to say that "economics is the science which studies human behaviour as a relationship between ends and scarce means which have alternative uses." "Economics is not concerned with ends as such." Nor is it concerned with technique, except in so far as it conditions the relative scarcity of different economic goods. Economics deals with relationships between things, not with the things themselves. "Scarcity does not mean mere infrequency of occurrence. It means limitation in relation to demand." All this is very true, but there is not much novelty in it. Professor Robbins takes the modern belief in mass-production as a cure-all and shows that, though technically satisfactory, it becomes uneconomic if it causes supply to outrun demand—a conclusion which no theorist ever doubted. Change in demand or scientific invention may make forms of fixed capital obsolete or railways unprofitable while still technically efficient, but the loss of the sums invested does not justify us in opposing a change, he says, "if the satisfaction of demand is assumed as the criterion of economic organization." The use of the term "economic quantity" is misleading; "to assume that the scale of relative prices measures any quantity at all save quantities of money is gratuitous metaphysics. Value is a relation, not a measurement . . . it follows that the addition of prices or individual incomes to form social aggregates

is an operation with a very limited meaning." "It is a further consequence of the conception of value as an expression of an order of preference that comparisons of prices have no precise significance, unless exchange is possible between the commodities whose prices are being compared. . . . The fact that bread last year was 8*d.* and bread this year is 6*d.* does not necessarily imply that the relative scarcity of bread this year is less than the relative scarcity last year." Not a few will think that "metaphysics" have crept in after all.

Space compels us to hurry on. "Instead of dividing our central body of analysis into a Theory of Production and a Theory of Distribution, we have a Theory of Equilibrium and a Theory of Variations. Instead of regarding the economic system as a gigantic machine for turning out an aggregate product and proceeding to enquire what causes make this product greater or less, and in what proportions this product is divided, we regard it as a series of interdependent but conceptually discrete relationships between men and economic goods; and we ask under what conditions these relationships are constant and what are the effects of changes in either the ends or the means between which they mediate." It is very truly added that "though the appearance of modern theory is new, its substance is continuous with what was most essential in the old." Different minds will require different modes of presentment, and, though here Professor Robbins will probably disagree, there is probably no best form of stating economic theory.

From the observation of scarcity relative to demand abstract deductions may be made as to its disposal and as to the effects on price of changes in supply or in demand, but the individual valuations which govern demand and the technical facts which govern supply are "outside the sphere of economic uniformity"—an "irrational element." Quantitative values cannot be given for such elementary concepts as demand and supply functions; "how much more does" this statement "apply to attempts to provide 'concrete' laws of the movement of more complex phenomena, price fluctuations, cost dispersions, business cycles, and the like." "The analytic method is simply a way of discovering the necessary consequences of complex collocations of facts—consequences whose counterpart in reality is not so immediately discernible as the counterpart of the original postulates." Its "laws" are formal, but when applied to practical problems they enable all the repercussions of a proposed action to be disentangled, so that it can be accepted or rejected with a full knowledge of the consequences. "Economics brings the solvent of knowledge. It enables us to conceive the far-reaching implications of alternative possibilities of policy. It does not, and it cannot, enable us to evade the necessity of choosing between alternatives. But it does make it possible for us to bring our different choices into harmony. It cannot remove the ultimate limitations on human action. But it does make it possible within these limitations to act consistently. . . . It provides a technique of rational action." In other words, economics is a discipline.

H. W. M.

7.—*Economics of a Changing World*. By H. V. Hodson. London: Faber, 1933. 7 $\frac{1}{2}$ " \times 5". 287 pp. 7s. 6d.

"This book," says the author, "does not profess to be an epitome of accepted economic theory." This notice does not profess to be a review, but an adjuration to all who are interested in the arrangement of social life to read an extraordinarily stimulating book. Those who object to anything provocative of thought had better leave it alone. The book, Mr. Hodson goes on, "is a straight-run account of economic theory as it appears to one who has read many works of the masters of the science and who has probably assimilated something from every one of them." His economics are not confined to the study. "Most of the works on economics for the layman," says Sir Arthur Salter in a preface, "usually deal entirely with what may be called the economics of equilibrium. They ask 'What is value?' 'Why is international trade profitable?' 'What determines the level of wages?' . . . We want our economics to be less of a static and more of a dynamic science. The questions to which we want answers are rather: 'Why do prices change?' 'How does unemployment come about?' 'What happens when one country lends money to another and balances of trade are upset?' It is questions of this kind that Mr. Hodson helps us to answer. His are the economics of change." The contrast should not, however, be pressed too far. The study of change is relatively difficult, that of balance relatively easy, and for analytic purposes it is best to begin with the latter. In fact, those readers will profit most by reading Mr. Hodson's book who already have an elementary knowledge of economics. So numerous are the text-books on the subject that a moderate degree of textual proficiency is easy of attainment.

What Mr. Hodson has done to a greater degree than most writers on economics is to relate abstract deductions to concrete problems, and he never forgets the value of the adjective "political" in the old title of the science—"political economy." An example is to be found in his treatment of "the so-called 'purchasing power parity' theory of international trade" on pp. 65-6, where he discusses the contents of the index-numbers of prices in two countries trading with each other, and shows that the theory is "based on the assumption, which cannot be justified in theory or in practice, that the prices of all commodities in any community move at the same time in the same direction and to the same extent." Fellows will remember Mr. Flux's discussion of international price comparisons in his paper in June of last year. Another matter affecting index-numbers is of particular interest to the present reviewer, who has often put forward similar views. "It must be made clear that in the analysis of changes in the general level of prices no class of values, that is objects of price, must be arbitrarily excluded . . . in choosing a representative set the economist must . . . satisfy himself if he can that a series of wholesale prices is representative of the prices of services as well as of material goods. . . . There are many reasons why in the analysis of price movements the prices of securities should be included with the prices of goods and services. They are one of the items on

which consumers spend their incomes : their transference from hand to hand effects a redistribution of income. . . . The general price level, then, is to be taken as including the prices of services and of securities as well as the prices of goods, though of course it may be analytically necessary to split it up for particular purposes into a wholesale price level, a retail price level, a security price level, or indices of the prices of labour, land, or any other class of values." This whole idea of a general price level is obviously "rough and empirical," and it is clear, as is shown in a later chapter, what difficulties surround attempts to stabilize prices by reference to some index-number.

The chapters on "The Changing Price Level" and on "The Business Cycle and Unemployment" are particularly well done, and call for quotation, but space forbids. A sentence, however, from the chapter on "Monetary Systems" (p. 221) catches the eye as it seems so peculiarly fit to be "set" in an examination paper. It runs : "A business boom with rising prices always implies that the resources of the world are being applied to purposes other than those voluntarily chosen by its population." The short answer comes in the following lines : "This misapplication takes the form of providing for future consumption on a larger scale than people individually would choose." Examinees or soon-to-be examinees are warned that there is more to it than that, as Mr. Hodson shows. The final chapter on "The Economic Future" holds out a "grim prospect" of a tendency to relative over-production of primary products for which there is an inelastic demand, so that their prices will vary widely and commodity prices in general will decline relatively to the average of all prices, producing a decline in business sentiment and a dislocation of international trade and finance. "If the economic system in which we live does not cure such disastrous defects they will prove its undoing. . . . At present our system is an anomalous confusion of economic unrestraint and public control." The final words are : "Economic progress has enabled us to make things more cheaply and to work less; in the depths of a depression it seems good to us to make things more dearly and to work harder, but doubtless the time will come when we shall be both able and content to be rich."

H. W. M.

8.—*Studies in World Economics*. By G. D. H. Cole. London : Macmillan, 1934. 8½" × 5½". vii + 285 pp. 12s. 6d.

This book consists of fifteen chapters on such varied subjects as World Economics, Consumers' Credit, Dr. Hayek's Triangle, Inheritance, etc., the materials for which, now worked up, are to be found in articles contributed to as great a variety of magazines or societies, from the *Christian Century* to the Aristotelian Society. They are bound together by the common idea "that economic conceptions and the theories built upon them need far-reaching revision in the light of the developing forces in the world of to-day." Mr. Cole can always be relied upon to write with even extreme lucidity, so that his argument flows so easily as to be sometimes almost deceptive, and if he often provokes contradiction he always stimulates thought.

Nevertheless, the book is not one to be read straight through, for that would certainly cause mental indigestion. Rather, one would dip into it from time to time, read a chapter, and ponder it.

Following this prescription we take first the last essay, on "Loyalties," read before the Aristotelian Society. Adopting Rousseau's doctrine that the common will is the underlying basis not only of the State but of all formal or informal associations of persons within the State and Hegel's principle that the State exists not in being but in becoming, he finds that the loyalties, or sense of social obligation, of men to the different groupings in which they move may conflict with one another and with their relation to the State. A common will develops in each association as in the State, but both come back to the individual will and each member of a group may strive "to make his particular group or association a means in its measure to the good of the whole." The aim, then, is harmony, not in the sense that there is only one good to be pursued along a single road, but in "the positive idea of the social will as finding its fullest expression where the wills of individuals find *their* fullest and most diversified expression through a rich variety of free associative life" (p. 276). This harmony, to be aimed at, "depends, first of all, on a basis of common ideas and assumptions broad enough to sustain the citizens in their common life, and finding substance in a set of social institutions which most people regard as, in essence, fair and reasonable. If this condition is not realized (and it is not, over a large part of the world to-day) the basis for the harmonious working of the associative life is knocked away, and men group themselves into rival factions, and develop essentially conflicting loyalties, based upon their rival conceptions of social justice" (p. 283). Here we seem to have got to the foundation of Mr. Cole's political philosophy. The advent of disharmony is considered from the economic point of view in the preceding chapter, "Towards a New Economic Theory." The progress of capitalism, he says, makes the old idea of a "'free market' Society of competing producers and consumers correspond less and less to economic realities" (p. 249). A Socialist economy is a planned economy, socializing the human as well as the non-human resources of production; even if it left the consumer free to choose between the available goods and services at the prices charged for them, all the factors of production would still be controlled. But whereas "the value theory of developed *bourgeois* Society is that of marginal utility, based on recognizing as ultimate the dictates of consumers' demand" (p. 266), "the Socialist standard of utility is found no longer in the price-preferences of private consumers, but in collective estimates of social need" (p. 263). We cannot follow Mr. Cole in his acute, though necessarily incomplete, application of this idea, but one wonders whether there may not be the possibility of the emergence in the Socialist State of those conflicts and disharmonies which characterize Society of to-day, unless by slow development the reconciliation of private preferences and social policy is achieved.

Turning to less fundamental problems, the seventh essay, on "Consumers' Credit," pricks many bubbles. The frequent disharmony of saving and investment is recognised, but "there is no

evidence of a permanent or persistent tendency towards a deficiency of total purchasing power in relation to the total volume of production" (p. 111). "The economic system can only work well and smoothly as long as the spending power available *and actually used* keeps pace with the volume of productive capacity, so as to enable all that can be produced to be sold at a price to cover costs, provided only that the different commodities and services are produced in the right relative quantities" (p. 120). For this we need planned production, equitable distribution, controlled prices, and a "controlled financial system designed to correct disequilibria due to the time factor"—"in other words, a complete Socialist system."

Well, here are three samples from Mr. Cole's menu, enough for one meal. Our appetite for the other items grows, but as for digestion—? It can be guaranteed, however, that each *plat* is well cooked, and if some are too rich or too unpalatable for some, Mr. Cole will recognize that as one of the inevitable disharmonies.

H. W. M.

9.—*International Combines in Modern Industry*. By Alfred Plummer, LL.D., etc. London: Pitman, 1934. 8½" × 5¼". ix + 191 pp. 7s. 6d.

This book, by the Vice-Principal of Ruskin College, Oxford, comes appropriately at a time when everyone is talking about "planning," when combines are expected to rationalize industry, and when it is hoped that private international industrial agreements may remove some of the worst forms of competition. The trouble in discussing international combines is that they are so varied in their scope, territorially, industrially, and financially, that general statements about them are difficult. Some are loose, impermanent, and fugitive; others are strong and lasting. Their general objects are to retain the home markets for national producers and to divide up the foreign markets on some agreed plan; they may or may not aim at increasing prices, they certainly try to stop a fall, and their main purpose is to increase the profits of the producer. The direct economic effect is to prevent the elimination of the marginal firms. "At best international combines may secure a more methodical organization of production, a rapid improvement of technique, and a reduction of costs; they may check wasteful competition and the wastes which result from wide and frequent fluctuations in industrial activity. At best they may assure steadier and larger profits to producers; steadier and higher wages to workpeople, and steadier and lower prices to consumers. These are their potentialities for good. At worst they may seize and abuse a monopolist position, arrest technical progress, and exploit consumers. They may drive extremely hard bargains with workpeople and customers and grow fat on profits inflated by a large element of monopoly 'rent' or surplus" (p. 161). In fact, they are like the little girl "who had a little curl"! Approval of them will depend upon whether their managers have the wisdom to see that their security depends on their identifying their interests with the long-term welfare of the community and in resisting the temptation to make exceptional profits out of a temporarily ad-

vantageous situation. That they have not always this wisdom is shown by the recent history of Copper Exporters, Incorporated.

After a preliminary historical survey Dr. Plummer describes the various types of international combines and discusses the conditions favourable and the obstacles impeding their formation. The arguments are not new, but the "old saws" are reinforced by "modern instances," in a manner as full as is possible, considering the tendency of such bodies to conceal their motives and cloak their actions. The possibility of conflict between private arrangements and public policy next comes under review, and the argument that the reservation of home markets makes protective tariffs unnecessary is dismissed because, among other reasons, tariffs tend to be permanent while combines, so far, are of temporary duration. The means of enforcing the regulations of the combine are then criticized; loyalty and discipline are difficult to secure and political forces sometimes intervene. "In the near future it may be found that instead of international cartels, industrialists will come more and more to prefer international concerns, largely because they are less likely to be thrown into confusion, and even destroyed, by tariff changes" (p. 125). "Control or no control, international combines are likely to increase and spread," and their final chance of survival will depend upon their being able to absorb "the advanced concepts of this New Age" and to co-operate with other forces, for "the nearer the purchasing power of the populations of the world can be brought towards their consuming power, the more trade and prosperity there will be for all" (p. 164). Altogether, a useful and interesting book.

H. W. M.

10.—*Industrial Relations in Great Britain*. Studies and Reports, Series A (Industrial Relations), No. 36. Geneva: International Labour Office; London: P. S. King, 1933. 9 $\frac{3}{4}$ " \times 6". xii + 273 pp. 3s. 6d.

This is the first of a series of studies of industrial relations in various countries which the International Labour Office is preparing to publish. The series forms part of a scheme of research on the subject undertaken as the result of a resolution adopted in 1928 by the International Labour Conference.

Professor Richardson begins by setting out the economic and social background, which includes brief but sufficient statistics of population, unemployment insurance, foreign trade, unemployment, wholesale prices, wages, health insurance and other public social services, as well as some figures regarding the co-operative movement. He then proceeds to deal with the trade union movement—its development, membership, legal position, structure and policy—and similarly with employers' organizations. Next comes what is perhaps the most interesting chapter of the book, namely, that concerned with methods of negotiation between trade unions and employers' organizations. This is succeeded by chapters on works councils, industrial welfare, labour management, and co-operation in national economic councils. It appears that the studies for other countries will be arranged on the same general lines and it is fervently

to be hoped that they will approach the high standard set by Professor Richardson.

In his concluding chapter the author states that "it was not until after the disaster of 1926 that the necessity of going to great lengths of mutual concession in order to avoid conflicts was at last realized throughout almost the whole of British industry." He is, however, not unmindful of the question whether the better relations which have subsisted during the last few years will be maintained when prosperity is restored, but he notes a desire on both sides "to avoid the attitudes and conflicts of the early post-war years."

Among the developments conducive to industrial peace which have been taking place we are told that the "bullying foreman has largely disappeared. More consideration is being given to the human factor, for reasons not of paternalism but of productive efficiency. This is indicated by increase in the number of labour managers, growth of welfare work, and greater interest in the results of scientific research into problems of industrial health and psychology." Other noteworthy developments are a wider recognition of trade unions and an extension of the system of works councils.

Professor Richardson is hopeful of the future. "Signs are not wanting that changes of outlook are slowly taking place. The old spirit of bitterness and violence of the nineteenth century resulting from low standards of working conditions, unwillingness of employers to recognize organizations of workers, and often their determination to destroy the unions, is giving place to better mutual understanding. More reliable data are being brought under review during negotiations, there is a greater willingness to face the facts, and, in consequence, the margin of difference between the two sides is being narrowed. . . . Above all, there is growing recognition of the common interests of employers and workers in the prosperity of British industry, especially in view of the intensity of post-war international competition."

There are appendices giving, *inter alia*, rates of wages and hours of labour in some of the more important industries in 1914 and 1931, membership of trade unions in the chief industrial groups in a pre-war year and certain post-war years, the constitution and functions of works councils in various trades, and the chief features of co-partnership, pension and other schemes in certain establishments.

J. W. V.

11.—*Fundamentals of Industrial Administration*. By Edward Tregaskiss Elbourne, M.B.E. London: Macdonald and Evans, 1934. 8½" × 5½". 644 pp. 12s. 6d. net.

This is probably the first really comprehensive book on Industrial Administration written in this country. During the last ten or fifteen years many authors have dealt with individual aspects of this vast subject, but Mr. Elbourne has attempted, and achieved, something more. His aim was to provide a handbook for the student of Industrial Administration and also a reference book for those already engaged in such work. The book will probably be more successful as an aid to the student than to the business man, but the latter will welcome the manner in which the author has dealt with

the newer developments, such as the functions of the personnel department and the control of all expenditure by means of budgets.

Naturally it is impossible to do more than pick out a few points of interest from a book which deals with so many and such varied subjects as company formation, rationalisation, the theory of international trade, the elements of commercial law, price maintenance, copyright, remuneration, and market research, to name only a few. The first part of the book enumerates the external factors governing both industry and commerce, and in this section Mr. Elbourne has had the needs of the examination candidate primarily in view. The second part is concerned with the practical conduct of industrial undertakings, and here an attempt has been made to interest those actually engaged in industrial administration by giving them a picture of industry as a whole into which they will be interested to fit their own particular activities.

In order that the present industrial system may be seen in proper perspective, Mr. Elbourne has devoted the first part of his book to an historical survey, describing the growth of industrialization from the Middle Ages to the nineteenth century, the industrial revolution, and the resultant economic and social changes. The main features of early technological development are shown for the textile trades, iron, coal, and engineering, and for transport and communications. The scope of modern industry is dealt with under five headings: the range of industries, numbers employed, regional distribution, size of industrial units, and the volume of production.

In the second part, Mr. Elbourne begins by outlining, firstly, the organization of production and, secondly, that of distribution, and proceeds to show the importance of development and research both from the production and distribution ends. The author is well known for his work on factory administration and cost accounts and it is more than likely that the chapters in this book will lead many people to take a deeper interest in those important aspects of industry and to go to his more detailed book for further information.

Throughout his book Mr. Elbourne stresses the importance of the human factor, and it is therefore not surprising that his final chapter should contain a plea for the introduction, wherever possible, of the personnel department—an institution which is working with success in the more enlightened factories and workshops of this country.

A very useful feature is the bibliographical index, containing the names of nearly one hundred books to which the reader is referred for more detailed information in particular subjects.

N. W.

12.—*Australia as Producer and Trader, 1920–1932.* By Nancy Windett, B.Sc. (Econ.). Oxford University Press; London: H. Milford, 1933. 9" x 6". 320 pp. 15s.

In his foreword to this book, which is issued under the auspices of the Royal Institute of International Affairs, Professor Coatsman says that "students of British Imperial Economic Relations in particular will be grateful for this completely objective study . . .

they must not look for any panacea or for sweeping generalizations because such will not be found here . . . the comprehensive synthesis of Australian industrial and trading processes contained in this book gives it the character of a new and unique study in the economic history of the country. . . ."

In a comprehensive introductory chapter the author deals with the geographical distribution of economic resources and population in Australia and then proceeds to study the effect of the war on her overseas trade, and the establishment of her secondary industries. Following the immediate post-war slump, there was from 1923 to 1927 a period of high prices, expanding production, heavy borrowing abroad, and a high level of immigration. In 1929 came the general collapse of wholesale prices, followed in 1930 by the financial crisis. The most recent phase has been one showing a reduction in retail prices and in the costs of production, and a rise in output and in exports of a number of primary products, although, as Prof. Coatman points out, the book was written before it was possible to say anything definite about the effects of the Ottawa agreements on Australian industry.

Attention is drawn to the declining importance to Australia of her trade with the United Kingdom, which was especially marked between 1920 and 1930. As far as exports from Australia are concerned, the decline arises from the relative inelasticity of the demand for certain foods, particularly wheat, the decline in British exports of woollen textiles, and the recovery and development of manufacturing industries in other countries, particularly Western Europe and Japan. The results of the collapse of prices and the depreciation of currency, combined with British tariff preferences and the arrangements made at Ottawa, have resulted in some increase in the proportion of exports to Great Britain, but Mrs Windett believes that the more permanent trend of Australian trade will be towards a greater diversity of markets, and a further decline in the proportion of exports to Great Britain. This depends, to some extent, upon the maintenance of the newly-found markets in China for wheat, and in Japan for wheat and wool.

In a chapter dealing with the direction of Australian overseas trade particular attention is drawn to the Pacific countries. Compared with the decade before the war, the Pacific countries have enormously increased their importance in the trade of Australia. In the pre-war days these countries, including Canada and the United States, accounted for just over one-fifth of Australian imports and a little more than one-tenth of the exports, whereas in the decade ending 1930-31 the proportion had changed to over one-third and about one-quarter respectively. As for other countries, the prospects of expansion in trade with China depend largely on an increase in purchasing power in China. A small *per capita* increase in consumption there would create important markets for Australian exports. China is deficient in animal foods and materials, and a rise in the standard of life would be likely to mean increasing imports of milk products, fruit, wheat, woollen and leather goods, and for the supply of many of these commodities Australia appears to have an advanta-

geous position. In Japan also there is a large potential market for foods which cannot be produced locally.

In considering the probable future direction of Australian overseas trade, the author emphasizes that it must be viewed as a thing of growth and of change. The real strength of Australia lies in the fact that most of the densely populated parts of the world are deficient in animal products and fruit, and the future growth in the consumption of these articles naturally depends on a rising standard of life among the poorer classes. The future sources of Australian imports will depend on the relative competitive positions of the United Kingdom and the United States, and to a lesser extent on those of Japan, Germany and France. A rising proportion of Australian imports is likely to be composed of commodities of the "newer" industries, such as electrical manufactures, motor vehicles, rayon, and machinery, and the proportion of the trade which will go to the United Kingdom will depend, therefore, on the development of her hitherto backward export trade in these commodities.

Mrs. Windett is to be congratulated on the excellent manner in which her book is documented. The majority of her references and figures are from official statistics, and indicate, to those interested in exploring the subject, where further material is available.

N. W.

13.—*Other New Publications.**

Allen (G. C.). British Industries and their Organization. London, New York and Toronto: Longmans, Green, 1933. 8½" × 5½". xi + 338 pp. 10s. 6d.

[The question of industrial planning is occupying considerable thought and evoking much discussion at the present time; and this book, the main purposes of which are "to consider the condition of British Industry since the war and to describe its present organization," should put the layman in possession of some of the essential facts required for the study of the problems involved. The author has deliberately restricted his field to a few representative industries, which he has dealt with intensively, after a preliminary chapter giving a general account of British industry before 1914. These staple trades, which are generally surveyed in relation to each other and to the whole industrial structure in Chapter II, are: Coal; Iron and Steel; Engineering; Shipbuilding and Marine Engineering; the Motor Trade; Textiles—Cotton; Textiles—Woolen and Worsted. Each is the subject of a careful study, in which the author traces the development and surveys the present position, giving the relevant facts, taken from recognized authorities, with admirable conciseness and just enough comment to illuminate them. There follow chapters dealing, respectively, with British Industry since the War and Changes in the Structure of Industry. It is to these that the reader will probably turn for guidance. He will not, however, find any specific prescription, but rather discussion of the probable consequences of this or that course of action—in the event of certain contingencies or in some other event—which should enable him to form an idea of the realities underlying appearances and of the complexity of the factors which contribute to the problem. A select bibliography and a good index complete the book.]

* See also "Additions to Library," p. 380.

Epstein (Abraham). *Insecurity: a Challenge to America*. A study of social insurance in the United States and abroad, with an introduction by Frances Perkins, U.S. Secretary of Labor. New York: Harrison Smith and Robert Haas, 1933. $8\frac{1}{2}'' \times 5\frac{3}{4}''$. xv + 680 pp. \$4.

[A vigorous plea for social insurance in America. As is well known, the forms of social protection already existing in several states of the Union have not been of much avail in coping with the enormous amount of distress caused by the acute depression of recent years. An analysis of the causes of the present widespread unemployment leads to the conclusion that certain classes of workers are at all times subject to the insecurity of employment which in the present crisis extends to all classes. Dr. Epstein would therefore urge the adoption of some comprehensive form of insurance for the American nation as a whole. He examines the voluntary and compulsory systems of unemployment insurance in other countries, comparing their relative merits and their respective appropriateness to the particular conditions of the United States. Insurance against sickness, old age, and invalidity pensions, workmen's compensation, and subsidies for mothers and children are studied in later sections of the book. The author maintains that the United States have the resources necessary to build up a sound system of social insurance which would lead to greater economic and social security. There is a good index.]

McCallum (E. D.), M.A. *The Iron and Steel Industry in the United States: a Study in Industrial Organization*. London: P. S. King, 1931. $8\frac{1}{4}'' \times 5\frac{1}{2}''$. 333 pp. 12s. 6d.

[The author, who is Lecturer in Economics at Armstrong College, collected most of the material for this book during his tenure of a Rockefeller Fellowship in the Social Sciences in the United States. He prefaces his study with an introductory chapter, in which he reviews the economic and social importance of the iron and steel industry in the United States, its development, actual magnitude and geographical distribution. The subsequent chapters treat of the Processes of Production, the Structure of the Industry, Industrial Combination, Marketing, Labour, the relation of Employers and Employed, and Rationalization, and the subject-matter in each is divided into definite categories, which are set out in a table of contents so that, even without the index, any particular section, such as annual earnings, hours of work, is easily found. The scaffolding of figures is exhibited in 54 tables; there are in addition four charts and three maps, the latter showing respectively the geographical distribution of blast furnaces, of Lake Superior iron ores, and of steel ingot producing plants.]

McGregor (A. G.). *Lasting Prosperity*. 2nd ed. London: Pitman, 1934. $8\frac{1}{2}'' \times 5\frac{1}{4}''$. xiv + 206 pp. 7s. 6d.

[The book has been revised and enlarged and includes an appendix discussing "President Roosevelt's Policies," and setting out the measures which in the author's opinion should be adopted in the United States.]

National Bureau of Economic Research. Publication No. 20. *The Purchase of Medical Care through fixed periodic Payment*. By *Pierce Williams*, assisted by *Isabel C. Chamberlain*. New York, 1932. $6'' \times 9''$. 320 pp. \$3.

[A survey made under the auspices of the National Bureau of Economic Research of available information as to the prevalence of arrangements for medical and clinical care for those affected by disease or injury not already covered by workmen's compensation laws. It is estimated that in 1930 over a million workers were protected by some form of medical

insurance, but the number is probably less now, since the labour strength of the industries concerned has been reduced. The book opens with a general survey of the subject and of the growth of interest in compulsory insurance in the United States. An account is given of the campaign for its introduction during the years 1914-20, and the reasons for its failure are discussed. The authors then describe the existing arrangements for giving hospital and medical care to different groups of workers, including the fixed payment medical services for those engaged in the lumber, mining, and railroad industries, and the services offered on a similar system by group clinics and community hospitals and by commercial accident and health insurance companies. Details are given of the Trade Union Sick Benefit Clubs, their methods of relief and their financial resources. The authors sketch out possible lines of future development in medical insurance and point out that different organizations are needed for rural and urban communities. The attitude of the medical profession towards contract practice is also discussed.]

Panandikar (S. G.). Industrial Labour in India. London: Longmans. 1933. 8½" × 5¼". iii + 299 pp. 9s.

[A survey of industrial conditions in India, and of the present position of legislation for the protection of industrial workers. The work is largely based on the Report of the Royal Commission on Labour in India, 1931, and especially on the eighteen volumes of evidence, which contain valuable information not available elsewhere, and which the Commission itself was unable to utilize adequately in the report owing to limitations of time and space. The book opens with a short history of Indian industries and the causes of their decline in recent times. Present conditions in the more important trades are described in detail, including wage-rates and standards of living, relations between industrial workers and employers, labour union movements, and the housing and general welfare of the workers. One correction should be made in any future edition of this book: the Chairman of the Commission was the Right Hon. J. H. Whitley and not "Mr. Whiteley."

CURRENT NOTES.

On p. 359 we give our usual table summarizing the overseas trade of the United Kingdom for the years ended February, 1933 and 1934. For the year 1933 the excess of imports over exports of merchandise amounted to £259 million. For the twelve months ended February, 1934, this excess was increased to £273 million. This increase was due to an expansion of trade, both imports and exports being higher in value than a year ago; the expansion has affected imports rather more than exports and was shown mostly in imports of raw materials, always a healthy sign for the prospects of British industry.

Total imports amounted in value to £121,960,000 during the first two months of this year as compared with £102,886,000 a year ago. Of the 43 groups comprising the three main classes of imports, 37 showed increases in value, while even in the few groups for which decreased values were recorded, much of the decline can be attributed to a fall in prices. Re-exports during the two months were valued at £9,283,000, being £643,000 more than in the corresponding period of 1933, while goods transhipped under bond increased in value from £4,113,000 to £4,376,000.

The value of the retained imports of food, drink and tobacco in the two months was £52.7 million, being larger by £2.3 million than a year earlier, due very largely to the increased value of the bacon and tea imported. Retained imports of bacon declined in quantity by 19 per cent. but increased in value from £3.9 million to £5.0 million. A similar result was recorded for tea—the quantity declining by 15 per cent. and the value increasing from £2.9 million to £3.7 million—and for mutton and lamb, though here the contrast was not so marked, while an opposite result was recorded for beef. There were considerable increases in the quantity and value of retained imports of sugar, tobacco, wine, barley and maize, but a substantial decrease for wheat.

Retained imports of raw materials were £10.9 million (47 per cent.) more than in January and February, 1933. Practically one-half of the total increase was in respect of raw wool, retained imports of sheep's and lambs' wool increasing by over 50 per cent., while the value more than doubled. Raw cotton increased in quantity by 21 per cent. and in value by 29 per cent. Large increases were

recorded for most other raw materials, among which may be mentioned in particular, wood and timber, iron ore, hides, wood pulp and rubber.

Imports of articles wholly or mainly manufactured also consist to a considerable extent of materials for industry. For this class as a whole there was an increase this year in retained imports amounting to £5,062,000 or 25 per cent. Non-ferrous metals—copper, lead, tin, zinc—all showed large increases, as did iron and steel, the increase being mainly in the crude and semi-manufactured forms. Imports of most descriptions of chemicals were substantially greater than in January and February, 1933. A large part of the increase for machinery consisted of machine tools. Imports of all descriptions of petroleum were higher this year than last. Newsprint was one of the few important commodities imports of which showed a considerable decline.

British exports during January and February were valued at £61,670,000, being £4,539,000 (8 per cent.) more than a year earlier. Exports tended to increase throughout last year and the latest figures indicate that the expansion is continuing. Two-thirds of the 43 groups comprising the three main classes showed increases, and only in respect of cotton yarns and manufactures did the decrease in any of the remaining 14 groups exceed £200,000. Increases in excess of this figure were recorded for 8 groups. Exports of spirits to the United States were £962,000 more than in the first two months of 1933, this being larger than the increase (£496,000) for food, drink and tobacco as a whole. The quantity of coal exported was larger by 228,000 tons (4 per cent.). The principal increases were in exports to Germany and Denmark, but exports to Sweden, Norway and Egypt also each increased by over 50,000 tons, while there were decreases exceeding that amount in the quantities exported to Belgium and Italy. The quantity of raw wool exported, which last year attained record dimensions, was 50 per cent. greater than in January and February, 1933; the value of the exports of raw wool, wool waste, etc., was £503,000 more than a year ago. The increase in value for raw materials as a whole was £799,000 (11 per cent.). For manufactured articles the increase amounted to £3,222,000 (7½ per cent.), all except three of the 20 groups in this class showing increases.

The tonnage of iron and steel exported increased by 21,000 tons (7½ per cent.), there being a substantial increase in exports of uncoated plates and sheets and of bars, rods, angles, etc. Exports of galvanized sheets and tinned plates were smaller, but railway material showed a considerable improvement compared with the very low

level reached in the first two months of last year. The increase in the tonnage of machinery exported was relatively larger (30 per cent.), the bulk of the increase being in textile machinery. Exports of aeroplanes, ships and boats, and motor-cars and chassis were each more than in January and February, 1933.

Among textiles, exports of cotton yarns increased, but there was a decrease of 45 million square yards (11 per cent.) in exports of cotton piece goods. Of the decline, 18 million square yards was in exports to British West Africa and 13 million in exports to China and Hong Kong; the exports to British India declined by 15 million square yards to 96 million, but the latter figure was substantially above that recorded for January and February, 1931 or 1932. Exports to the Union of South Africa continued to show a very marked improvement, and in January and February this year South Africa was our second largest market. The improvement in woollen exports shown last year continued into 1934, exports during January and February being higher than a year earlier in respect of tops, yarns, tissues and carpets, the total value of the exports amounting to £5,235,000, an increase of £922,000. A considerable increase was recorded in exports of artificial silk tissues and jute piece goods, while exports of linen piece goods were maintained at the high level of last year.

The groups in which the main changes were recorded have been dealt with above apart from non-ferrous metals, in which there was an increase of £470,000 (41 per cent.) and electrical goods and apparatus £194,000 (19 per cent.). In the non-ferrous metals group part of the increase was due to price changes, but there were considerable increases in exports of tin, nickel, and copper manufactures. Among other items, motor tyres and leather boots and shoes showed a small decline and ammonium sulphate a substantial one; and a general increase in value in respect of men's and women's outer garments was reported.

Following on the adoption by the United States of a gold bullion standard in January, the movement of gold bullion and specie into and out of this country during the first two months of the year was unprecedented. Imports during the two months amounted to £102·4 million, of which £59·3 million came from France, and exports to £49·6 million, of which £47·7 million went to the United States. The above figures show a continuance of the tendency for gold to accumulate in this country. Last year the excess of imports over exports of gold amounted to £191·3 million, and for the first two months of this year to £52·8 million.

Movements and Classes.	Twelve Months ended 25th February, 1933.	Twelve Months ended 28th February, 1931.	Increase (+) or Decrease (-).			
Imports, c.i.f.—	£'000.	£'000.	£'000.			
Food, drink and tobacco	360,174	342,987	(—) 17,187			
Raw materials and articles mainly un- manufactured	160,431	191,683	(+) 31,252			
Articles wholly or mainly manufac- tured	146,406	156,203	(+) 9,797			
Other articles	5,222	4,048	(—) 1,174			
Total Imports ...	672,233	694,921	(+) 22,688			
Exports, f.o.b.—						
<i>United Kingdom Produce and Manufactures—</i>						
Food, drink and tobacco	30,708	28,281	(—) 2,427			
Raw materials and articles mainly un- manufactured	43,604	46,788	(+) 3,184			
Articles wholly or mainly manufac- tured	273,822	284,375	(+) 10,553			
Other articles	12,886	12,520	(—) 366			
<i>Imported Merchandise—</i>						
Food, drink and tobacco	13,567	12,237	(—) 1,330			
Raw materials and articles mainly un- manufactured	24,071	26,125	(+) 2,054			
Articles wholly or mainly manufac- tured	11,021	11,124	(+) 103			
Other articles	311	234	(—) 77			
Total Exports ...	409,990	421,684	(+) 11,694			
Bullion and Specie—						
Imports	147,477	343,600	(+) 196,123			
Exports	129,139	87,198	(—) 41,941			
Movements of Shipping in the Foreign Trade—	Number of Vessels.	Thousand Net Tons.	Number of Vessels.	Thousand Net Tons.	Number of Vessels.	Thousand Net Tons.
<i>Entered with cargoes—</i>						
British	23,971	34,907	23,624	35,637	(—) 347	(+) 730
Foreign	22,127	23,609	24,095	25,421	(+) 1,968	(+) 1,812
Total entered ...	46,098	58,516	47,719	61,058	(+) 1,621	(+) 2,542
<i>Cleared with cargoes—</i>						
British	31,458	34,387	28,997	33,890	(—) 2,461	(—) 497
Foreign	18,971	20,637	20,308	21,902	(+) 1,337	(+) 1,265
Total cleared ...	50,429	55,024	49,305	55,792	(—) 1,124	(+) 768

As measured by the Board of Trade Index-Number general wholesale prices increased somewhat during January and February, 1934, but declined during March owing principally to a fall in food prices, especially those of meat and fish. The general index-number (1930 = 100), for March, viz. 87.0 is still nearly 1 per cent. above that for December, 1933 (86.1), while the index-number for materials (91.3) is nearly 3 per cent. higher in spite of a slight fall in most articles except iron, steel and tin, during March. The fall in the prices of meat and fish has been considerable, the index-number declining from 81.0 in December to 75.2 in March, or over 7.1 per cent. The prices of bacon have advanced since December, and the prices of Danish green sides were more than 50 per cent. above the low prices for January and February, 1933. Prices of New Zealand butter, on the other hand, have declined considerably compared with those obtainable during the autumn. The prices of tea have remained very high during the last eight months, with an average price of Indian teas at the London auctions during the last three months of 16.6*d.* per lb. compared with 9.4*d.* and 9.7*d.* in December, 1932, and January, 1933, an advance of over 70 per cent. From March, 1933, tea prices have advanced practically continuously, reaching their higher points at the January auctions—16.8*d.* per lb.

Wholesale food prices in the last week of March, 1934, were about 7.9 per cent. below the level of 19 September, 1931, when the gold standard ceased to govern currency issues, but the prices of materials were about 12 per cent. above that level. The index-numbers of wholesale prices as calculated by the Board of Trade (base year 1930 = 100) are set out below for the last four months.

Month.			Total Food.	Total not Food.	All Articles.
December, 1933	...	...	81.4	88.7	86.1
January, 1934	...	...	82.5	90.7	87.7
February, 1934	...	...	82.1	91.8	88.2
March, 1934	...	...	79.6	91.3	87.0
March, 1933	...	...	80.6	82.4	81.7
„ 1932	...	...	91.3	85.7	87.6

As compared with prices ruling in 1913 the general of prices in March, 1934, showed an advance of about 3.8 per cent., food prices an advance of less than 1 per cent. and materials 5.4 per cent. As compared with 1924 general prices showed a decline of 37.5 per cent. in March, 1934.

The *Economist* index-number (1927 = 100), which at the beginning of January, 1934, stood at 63.9, had advanced to 66.0 by the middle of February, but has since declined slightly to 65.4 at the end

of March, a decline chiefly due to a fall in cereals, 2.9 per cent., and textiles 1.7 per cent. As compared with the end of March, 1933, the index-number shows an advance of 9.4 per cent. due principally to rises in textiles and minerals.

The index-number of general prices as calculated by the *Statist* indicates a rather greater advance, 2.75 per cent., in the first three months of 1934 than is shown in the index-numbers of the Board of Trade (1.0 per cent.) and the *Economist* (2.3 per cent.). At the end of March the general index-number (average of 1866-77 = 100) stood at 82.2 compared with 80.0 at the end of December, 1933, and 82.5 at the end of January and February, 1934. The figure for food-stuffs rose from 74.3 in December to 75.5 in March, and materials from 84.1 to 87.0.

The British index-numbers and those for France, Germany and United States are set out below for the latest months.

	Board of Trade (1930=100)	<i>Economist</i> (1927=100)	<i>Statist</i> (1866-77= 100).	U.S.A. Bureau of Labour (1913=100).	France (<i>Stat. Gen.</i>) (1913=100).	Germany (<i>Stat. Reichsamt</i>) (1913=100).
Dec., 1933	86.1	63.9	80.0	101.4	389	96.2
Jan., 1934	87.7	65.7	82.5	103.4	388	96.3
Feb., 1934	88.2	65.9	82.5	105.4	384	92.2
March, 1934	87.0	65.4	82.2	—	380	—
<i>March, 1933</i>	<i>81.7</i>	<i>59.8</i>	<i>77.0</i>	<i>86.2</i>	<i>385</i>	<i>91.1</i>

The appreciation in the value of Stock Exchange Securities in 1933 continued during the first three months of 1934, and the index-number of Stock Exchange Values published monthly in the *Bankers' Magazine* showed at 19 March a rise of 4½ per cent. since December, 1933. The rise was most noticeable in the group of Variable Dividend Securities (7.2 per cent.). In the Fixed Interest Stocks it was about 3.4 per cent. Both the Preference and Ordinary Stocks of British Railways continue to appreciate and there has been a marked advance in the price of United States Gold Bonds.

The index-numbers for the last few months are given below. (Prices at December, 1921 = 100.)

Date.	Fixed Interest Stocks.	Variable Dividend Securities.	Total.
— December, 1933 ...	122.0	108.4	117.6
— January, 1934 ...	123.6	113.8	120.4
19 February, 1934 ...	124.3	115.8	121.5
19 March, 1934 ...	126.2	116.2	122.9
<i>18 March, 1933 ...</i>	<i>118.4</i>	<i>96.2</i>	<i>111.2</i>

The appreciation in value of the Variable Dividend Securities since 18 March, 1933, is rather more than 20 per cent. and their index-number is higher now than at any time since March, 1931. That for Fixed Interest Stocks is the highest since 1922.

Shipping freights remain low and the Chamber of Shipping index-number for March, 1934, shows a fall of about 4 per cent. as compared with February and January. The index-numbers for these months were 18·26, 19·01 and 19·04 respectively. For this index-number the geometrical average for the year of very high freights, 1920, is taken as 100, and in none of the succeeding years has the number approached that of the base year. Indeed in only one year, 1921, has the average numbers for the year exceeded 30.

According to the index-number of *retail prices* of articles of working-class consumption prepared in the Ministry of Labour there has been a continuous fall in general food prices since the beginning of December, 1933. Food prices fell during the first half of 1933, and at June 1, 1933, were only 14 per cent. above the level of July, 1913, but during the succeeding six months prices gradually rose and at the 1 December, 1933, the index-number had reached 126. A monthly fall of 2 points during the following four months has brought the number down to 118, so that retail prices are now nearly 3 per cent. above the prices current a year ago. The recent fall is principally seasonal. Butter, eggs, and margarine are now considerably lower in price (10 to 20 per cent.) than at July, 1914; tea, bacon, beef and mutton are higher with increases of 10 to 40 per cent. The present prices of fish are recorded at more than double those of July, 1914. No change in the prices of the other articles composing the index-number has been shown during the last six months except a slight seasonal advance in the price of coal, and the index-number for all items (food, rent, clothing, fuel and light, etc.) was 139 at the end of March, 1934, compared with 142 at the beginning of January, 1934, and 137 twelve months ago.

The returns of retail sales prepared by the Bank of England and the Association of Retail Distributors show for February, 1934, an increase in value of sales of 3 per cent. compared with February, 1933. This is the fifth successive month in which an increase has been shown, thus breaking for a considerable period the practically continuous monthly decreases in sales since August, 1930. As so far as it is possible to ascertain, there has been no proportionate increase in prices in any direction, it is fair to assume that there is now some appreciable increase in the consumption of food and goods. For the last two months there has been added to these figures an

index-number based on the average value of daily sales in 1933. The index-numbers for January and February are given as 101 and 91 respectively. Examining the monthly numbers for the years 1932 and 1933 it is seen that daily sales in December are much higher than in any other month, being 126 and 131 in 1932 and 1933 respectively. Sales are lowest in August, falling to 86 in each year, and are somewhat above the average in April, May, October and November.

The following table gives for the principal foreign countries and British Dominions the percentage increases on 1 July, 1933, and on the latest available date in the retail prices of food and other articles (rent, clothing, fuel, etc.) compared with the prices at July, 1914.

	Retail Prices of Food at		Retail Prices of all Items at		Date of Latest Return.
	July, 1933.	Latest date available.	July, 1933.	Latest date available.	
Great Britain ...	18	18	38	39	31 March, 1934
<i>British Dominions.</i>					
Australia ...	18 *	18	18 †	17 †	Jan., 1934
Canada ...	-5	9	20	26	March, 1934
Irish Free State	29 *	33	49 *	52	Feb., 1934
New Zealand	4	9	27	28	Feb., 1934
South Africa ...	-2	4	14	16	Feb., 1934
<i>Foreign Countries.</i>					
Austria (Vienna) ...	4	1	5	5	March, 1934
Belgium ...	—	—	595	577	March, 1934
Czechoslovakia ...	6	0	—	—	Nov., 1933
Denmark ...	—	—	60	62	Jan., 1934
Egypt (Cairo) ...	1	-3 †	24	23	Jan., 1934
Finland ...	777	719	883	853	Feb., 1934
France (Paris) ...	408	402	416 †	426 §	March, 1934
Germany ...	11	14	19	21	Feb., 1934
Holland (Amsterdam)	17	28	37	43	Dec., 1933
Italy ...	293	292	—	250 ||	Feb., 1934
Norway ...	32	28	48	55	March, 1934
Spain (Madrid) ¶	80	85	—	—	Oct., 1933
Sweden ¶	23	22	53	53	Jan., 1934
Switzerland ...	16	16	31	31	Feb., 1934
United States ...	5	8	28	35 **	Feb., 1934

* August, 1933. † November, 1933. ‡ 3rd Quarter, 1933. § 4th Quarter, 1933.
 || 2nd half, 1933. ¶ Includes fuel and light.
 ** December, 1933.

Apart from the usual seasonal set-back at the beginning of January, employment continued to improve throughout the first three months of 1934 and the numbers recorded as unemployed by the Ministry of Labour had fallen at the end of March below those recorded in December, 1933. The earlier date of Easter may have

had the effect of quickening re-employment somewhat more rapidly this year, but employment has improved appreciably in practically all the principal industries. There was some slight decline in March in the woollen and worsted trades, but the proportion unemployed at the end of March in this industry was considerably below that in most of the more important trades.

The percentage unemployed in the insured trades in Great Britain and Northern Ireland was 17·3 at the end of March, 1934, compared with 18·2 at the end of February, 18·7 at the end of January and 17·6 at the end of December, 1933. At the end of March, 1933, it was 21·9 per cent. Unemployment was highest in Wales (33·3 per cent.) and lowest in London (10 per cent.), the South-Eastern District (9·7 per cent.) and in the Midlands (12·7 per cent.). In Scotland and in the North-Western and North-Eastern Districts it ranged between 21 and 25 per cent.

Unemployment in the cotton trade remains high with very small indications of any improvement. Though the proportion unemployed in all the engineering and metal trades is still high, there was a marked improvement at the end of March compared with the position in March, 1932 and 1933. In marine engineering, however, the rate of unemployment is still as high as 37·1 per cent., although there has been some appreciable improvement latterly consequent on somewhat better employment in shipbuilding. There was considerable improvement in the clothing trades and in building, but this was to a great extent seasonal. Shipbuilding and Public Works Contracting still remain the two industries with the largest proportion of unemployed workers (53·0 per cent. and 45·9 per cent. respectively).

The numbers on the registers of the employment exchanges in Great Britain at the end of each of the last four months are given below.

Date.	Wholly Unemployed.	Temporarily Stopped.	Persons normally in Casual Employment.	
Dec. 18, 1933 ...	1,830,977	308,821	84,281	2,224,079
Jan. 22, 1934 ...	1,944,026	355,240	89,802	2,389,068
Feb. 19, 1934 ...	1,881,532	340,897	95,480	2,317,909
March 19, 1934 ...	1,796,787	312,622	92,168	2,201,577
<i>March 20, 1933 ...</i>	<i>2,170,252</i>	<i>503,377</i>	<i>102,555</i>	<i>2,776,184</i>

Unemployment in Germany continues to show a marked decline and the number of persons reported by the Employment Exchanges as unemployed at the end of March, 1934, was 2,798,892 compared

with 4,058,000 at the end of December, 1933. To what extent these figures are comparable with those for March, 1933, is not quite clear, but at the latter date the number recorded in official returns as unemployed was over 5½ millions. The number in receipt of unemployment benefit at the end of March, 1934, was 1,160,325, of whom 249,480 received standard benefit and 910,845 emergency benefit. At the end of December, 1933, the total number was 1,728,955 and at the end of March, 1933, 2,165,891. (For the last few months there has been published in official returns the proportion unemployed among members of the "German Labour Front," who at the end of February, 1934, numbered 6,656,406. It is not certain whether this proportion (20.1 per cent. at the end of February) is in addition to those registered at Employment Exchanges, but even if such is the case there would still be a reduction in the total numbers unemployed in March, 1934, of about one and a half millions as compared with March, 1933).

Very little change in employment in France has taken place during the last three months and the numbers out of work are somewhat greater than in March, 1933. According to the special monthly investigation covering the principal industrial, transport, and commercial undertakings (*i.e.* those employing at least 100 workpeople) the numbers employed at the beginning of March, 1934, were less by 1.7 per cent. than the numbers employed at the corresponding period a year ago. Of those employed about 19 per cent. were working less than 40 hours per week. The number on the registers of Employment Exchanges was 379,000 at the end of March compared with 307,000 at the end of December, 1933, but these figures are a very incomplete record of the amount of unemployment.

Employment in Italy shows very little change, but the number of members of the National Social Insurance Fund recorded as unemployed at the end of February, 1934 (1,103,550), was somewhat less than at the end of December, 1933, and 125,000 less than at the end of February, 1933.

In the Scandinavian Countries employment remains depressed, and though better than at the end of 1933, the percentage unemployed among members of Trade Unions remains very high, being 31.3 per cent. and 24.1 per cent. in Denmark and Sweden respectively at the end of February and 35.6 per cent. in Norway at the end of January. Except in Denmark, however, where the figures include also the unemployment recorded by the Central Employment Exchange, the numbers covered by the returns are not very considerable.

In Belgium employment declined at the end of December, 1933,

and 19.9 per cent. of the 980,000 members of Approved Unemployment Insurance Societies were recorded as unemployed and 16.6 per cent. as intermittently employed during the month. Employment, however, during the latter half of the year was distinctly better on the whole than in the earlier half and much better than during 1932.

In Austria and Czechoslovakia employment was better on the whole in the first three months of 1934 than in 1933, but in Poland the numbers registered at Employment Exchanges at the end of January, 1934 (399,660), were higher than at the corresponding dates in 1933 and 1932 (266,600 and 338,400 respectively). In Holland employment improved somewhat during January, 1934, and was better on the whole than a year ago.

Employment in the United States continues to improve and the index-number of employment (1926 = 100) issued by the Federal Bureau of Labour, which was as low as 55.1 in March, 1933, stood at the end of March, 1934, at 73.5. Apart from the seasonal falling off in the winter months there has been a continuous improvement since March, 1933, though the index-number for February is slightly under those for September and October, 1933 (73.9 and 74.0). Returns received from about 18,000 representative establishments in the principal manufacturing industries show an increase in the numbers employed in February, 1934, over January of 6.1 per cent. The wages bill in these establishments show an increase of 12.1 per cent. over the same period. Returns from the American Federation of Labor point in the same direction, the rate of unemployment amongst affiliated unions in twenty-four American cities having fallen to 26 per cent. in February compared with 34 per cent. in February, 1933, and an average of 31.5 per cent. for the whole of 1933.

There has been a noticeable improvement in employment in Canada, and it is now better than at any time during 1932 and 1933. The index-number of employment (1926 = 100) issued by the Dominion Bureau of Statistics stood at 92.7 at the beginning of March, 1934, or higher than at any time since December, 1931. It had fallen as low as 76.0 at the beginning of April, 1933—the lowest point reached.

In Part I of the *Journal* for this year an account was given of the first volume of the Final Report of the Census of Production for 1930, covering the Textile, Leather, and Clothing Trades. The second volume (506 pp., price 7s. 6d.) has now been issued by the Stationery Office, and deals with the Iron and Steel Trades, the Engineering, Shipbuilding, and Vehicle Trades, and the Non-Ferrous Metal Trades.

The general character of the Report is similar to that of the first volume, but a few points of general interest may be extracted. The first is a warning that comparability with the 1924 Final Report is affected by the adoption in 1930 of a new trade heading, "Iron and Steel Foundries," which absorbed the 1924 heading, "Light Castings Trade," and part of certain other trades. The 1924 returns have now been re-classified so as to be comparable with the 1930 results. The number of persons employed in the Iron and Steel Trades by firms employing more than ten persons fell from 498,912 in 1924 to 493,577 in 1930 and the net output per head from £198 to £186, while the "power available" rose by 8·8 per cent. In six of the thirteen trades in this group the net output per head—Blast Furnaces, Hardware, Tubes, Cutlery, Small Wares, and Small Arms—increased. The contrast between Blast Furnaces with an increase from £195 to £204 and Iron Smelting and Rolling Works with a decrease from £203 to £187 is remarkable, and may, perhaps, be attributed to improved methods in the former case. In the second group there are seven trades which employed 985,578 persons in 1924 and 1,074,749 in 1930 and showed an aggregate net output per head of £201 in the earlier year and £214 in the later, power available increasing by 17·4 per cent. Shipbuilding, the Railway Carriage and Wagon Trade, and the Carriage, Cart, and Wagon Trades showed decreases in the number of persons employed, but the first two nevertheless recorded increases in net output per head, due probably to better organisation and the elimination of the weaker firms; the last-named showed a decrease. The increase in the number of persons employed in the Motor and Cycle Trades by 25·4 per cent. to 241,710 in 1930, coupled with a decrease of 4·7 per cent. (from £232 to £221) in the net output per head seems to reveal the stress of competition. The seven Non-Ferrous Metal Trades decreased both in persons employed (from 114,988 to 109,718) and in net output per head (from £220 to £215), but there was an increase of 24·4 per cent. in power available. All, except the small section of the industry in Northern Ireland, showed reductions in the net output per head.

Considering only the output of Great Britain, seven trades in the first group, four in the second, and three in the third had a total output in 1930 which was greater in volume than that of 1924. The principal of these were:—Hardware, 34 per cent.; Cutlery, 26 per cent.; Chains, Nails, etc., 17 per cent.; Tubes, 15 per cent.; Electrical Machinery and Apparatus, 33 per cent.; Motors and Cycles, 52 per cent.; Aircraft, 187 per cent.; Watches and Clocks, 72 per cent.; Finished Brass Goods, 25 per cent.; Lead, Tin, etc., 16 per cent. The greatest decreases were:—Pig Iron, 16 per cent.; Crude Steel and Rolled Products, 19 per cent.; Small Arms, 41 per cent.; Rail-

way Carriages and Wagons, 32 per cent. Taking together all the trades covered by this volume, 72.6 per cent. of the returns were received from firms employing from 11 to 99 persons and 21.1 per cent. from firms with 100 to 499 employees, but the portions of the aggregate net output contributed by those two classes of firms was 15.7 per cent. and 28.4 per cent. respectively. On the other hand, firms with from 500 to 999 employees contributed 3.8 per cent. of the returns and 17.3 per cent. of the net output, and firms with 1,000 employees or more furnished 2.5 per cent. of the returns and 38.6 per cent. of the net output. In the Engineering, Shipbuilding, and Vehicle group 195 returns from firms employing 1,000 persons or more—or 3.2 per cent. of the total number of returns—furnished 46.8 per cent. of the net output. It is very difficult to extract from the figures published any measure of the efficiency of firms according to their size, and, indeed, for the Iron and Steel Group the Report says that “the figures of net output per person employed give little evidence of any definite tendency of direction according to the size of the establishments.” Among blast-furnace firms, for example, we get a net output per head of £389 for firms with 25–49 employees and £324 for firms with 1,000 and over, and in smelting and rolling firms those with 11–24 employees show the highest net output—£235—while those with 1,000 or more employees earned only £182 per head. The Engineering and Vehicle Trades show more evidence that size is an element in efficiency. Thus in Mechanical Engineering there is an increase in net output per head as the firms grow larger, with five breaks in the progress through the eleven classes into which the firms are divided; in Electrical Engineering there are four breaks; in Motors and Cycles, four; in Shipbuilding there is a steady increase in the first five classes, a very sharp break in the next (300–399 employees), then a sharp recovery followed by a fall through three classes, and a recovery among firms with 1,500 workers or more. Among the Non-Ferrous Trades the returns are quite irregular. Obviously, the analysis provided by the Census authorities is not sufficiently detailed to enable us to be certain that we are grouping together firms engaged in turning out the same class of product.

Although the returns relating to firms in Northern Ireland are included in the Reports of the Census of Production reviewed above, a separate report was also issued early last year for the industrial production of Northern Ireland. Consequently, it does not include the revisions which have been made later, and some caution should be observed in using it. Fortunately, however, those revisions have not affected the net output per head to any material extent. A sharp contrast is seen between the results of the Textile group of trades and

the Engineering group, the former of which included half of the industrial operatives of Northern Ireland in 1930 and the latter 17·6 per cent. In the Textile group (dominantly linen) the net output per head fell from £128 in 1924 to £99 in 1930, while in the Engineering group there was an increase from £159 to £175, a decrease from £193 to £165 in shipbuilding being more than offset by an increase from £134 to £194 in mechanical engineering; this sharp rise was due to a great growth in the output of internal combustion and turbo-electric marine engines.

The International Diplomatic Conference for the standardization of the methods of sampling and of analysing cheeses, recently held at Rome at the International Institute of Agriculture, has now finished its work with the following result.

The representatives of fourteen States have signed an International Convention which, in cases of dispute arising in the international cheese trade, establishes and fixes standardized methods for sample-taking and for the analysis of cheeses.

This Convention will come into force six months after the date of the notification of the third ratification of its terms has been received by the Italian Ministry of Foreign Affairs, which is the depositary of the original text of the Convention and of the actual ratifications.

In connection with the actual drafting of the Convention, the International Institute of Agriculture worked in close collaboration with the International Dairy Federation, which has its head-quarters at Brussels and is an international body, in which all aspects of the Dairy Industry are united.

The British Association is to meet this year in Aberdeen from September 5 to 12. Professor H. M. Hallsworth will preside over Section F (Economic Science and Statistics) and will deliver his presidential address on "The Future of Rail Transport" on Friday, September 7. For Monday, September 10, an important discussion on "Economic Planning" has been arranged. This will be opened by Professor D. H. Macgregor and summed up by Sir Josiah Stamp, and among the other speakers will be Professor Alexander Gray and Professor W. F. Bruck. Another session is to be devoted to Scottish Economic Problems, and in this the contributors will be Dr. Hamilton on "Organization of the Fishing Industry"; Mr. W. H. Marwick on "The Economic Development of Victorian Scotland," and Mr. E. D. McCallum on "Recent Economic Changes in Scotland." Among other papers, we may mention those by Mrs. Cartwright on Statis-

tical Investigation into Industrial Fluctuations; Professor Bruck on "Risk and its Significance in Modern Economy"; Mr. Eastham on some aspects of Regulated Marketing, and Professor Ogilvie on "The Significance of International Trade Accounts." In the afternoons, special sessions arranged by Section F will be devoted to industrial problems including a session on "The Need for a Technique of Economic Change" which will be opened by Sir Josiah Stamp.

Further particulars of the arrangements can be obtained from the Recorder of the Section, Dr. K. G. Fenelon, College of Technology, Manchester, 1.

The Council of the Manchester Statistical Society, as part of its Centenary activities this year, approved the formation of a special Group of its members for the discussion of statistical methods and their application. This Group, which has been organized on lines somewhat similar to those of the Study Group of our own Society, held its first meeting last January, when Lord Crawford and Balcarres presided and Mr. Colin Clark opened a discussion on the Statistical Measurement of Business Activity. In February Mr. L. H. C. Tippett read a short paper on The Analysis of Time Series, and at the March meeting Mr. C. T. Saunders spoke on the importance of Seasonal Fluctuations in Employment. In April Mr. Champion led a discussion on Recent Work on the Measurement of Price Changes. Monthly meetings of the Group are being arranged for next session. We are asked to make it known that Fellows of the Royal Statistical Society will always be welcome at these meetings; they should communicate with Mr. H. Champion, the University, Manchester. We note with interest that three of the four papers mentioned above were read by Fellows of our Society.

The fourth meeting of the Industrial and Agricultural Research Section, the last of the current session, was held on May 31st. The attendance at these meetings and the keenness of the discussions evoked is evidence of the interest taken in the work with which the Section is concerned. As already announced, the papers read at these meetings, with the discussions and shorter articles dealing with statistical method, will be published in special Supplements to the *Journal*. The first of these Supplements is being issued simultaneously with this number of the *Journal*, and will contain the first two papers read, namely, Application of Statistical Methods to Production and Research in Industry, by Dr. R. H. Pickard, F.R.S., Director of the British Cotton Industry Research Association, and Statistics in Agriculture, by Dr. John Wishart, of the School of Agriculture,

Cambridge, and, among other matters, a Bibliography of Agricultural Statistics, prepared by Dr. Wishart. Any Fellow who is interested may receive a copy of this and of each future issue, with his Journal (Parts II and IV). The price, to those who are not Fellows, has been fixed at five shillings for each part, and a subscription of ten shillings a year will confer the right to attend the Section meetings as well as to receive both issues of the Supplement.

STATISTICAL AND ECONOMIC ARTICLES IN RECENT PERIODICALS

UNITED KINGDOM—

Annals of Eugenics—

Vol. V. Parts I-II—A biometric investigation of twins and their brothers and sisters, Part II: *Percy Stocks* and *Mary N. Karn*. A pedigree showing mental defect in four generations: *C. H. Usher*. On the inheritance of duration of life and of cause of death: *Brenda Stoessiger*. On the spread of small-pox in partially vaccinated communities, I: *Percy Stocks*.

Vol. V, Parts III-IV—A co-operative study of the habits, home life, dietary and family histories of 450 cancer patients and of an equal number of control patients: *Percy Stocks* and *Mary N. Karn*. On the spread of small-pox in partially vaccinated communities, II: *Percy Stocks*. On the inheritance of migraine: a preliminary note: *Julia Bell*. The Lanarkshire milk experiment: *Ethel M. Elderton*. Appendix to Dr. Elderton's paper on "The Lanarkshire milk experiment": *Karl Pearson*. Mathematische Betrachtungen zur Rassenhygiene, insbesondere zur Sterilisation: *Ewald Bodewig*.

Bankers' Magazine—

February, 1934—The commodity dollar: *F. C. Goodenough*. The present relation of gold to finance: *Benjamin White*.

March, 1934—The rise in gilt-edged values: an attempt to analyse its causes: *W. T. Hart*. Reserve banking in New Zealand: *Hugh C. Jenkins*.

East India Association, Journal, April, 1934—Population and health in India: *Maj.-Gen. Sir John Megaw* (with discussion).

Faculty of Actuaries, Transactions, Vol. XIV. Part VIII—The mortality of female assured lives: *D. G. Kellock*.

Institute of Bankers, Journal, February, 1934—The practice of bankers in relation to further types of security. Gilbert lectures, 1934, lecture 1: *Professor J. H. Jones*.

Midland Bank Monthly Review—

January-February, 1934—Britain's monetary policy, the wisdom of expansion: *Rt. Hon. R. McKenna*.

March-April, 1934—Gold and money, international effects of American devaluation.

Lloyds' Bank Monthly Review—

February, 1934—The policy for sterling: *J. H. Jones*.

April, 1934—The basic American problems: *Robert B. Warren*.

UNITED KINGDOM—Contd.

Population, February, 1934—Population changes in England and Wales, families and dwellings, 1921–1931: *E. C. Rhodes*. The history of longevity in the United States: *Louis I. Dublin* and *Alfred J. Lotka*. A note on the population of Egypt: *M. El-Darwish* and *H. el S. Azmi*.

Review of Economic Studies, February, 1934—Materials for a theory of the duration of the process of tax shifting: *M. Fasiani*. The nature of indifference curves: *R. G. D. Allen*.

IRISH FREE STATE—

Department of Agriculture, Journal, No. 2, 1933—A study of the potato eelworm (*heterodera schachtii*) in the Irish Free State: *J. Carroll*.

AUSTRALIA—

Economic Record, December, 1933—Saving and investment in monetary theory: *E. R. Walker*. Progress in Australian tariff policy: *J. B. Brigden*. A business index for Australia: *E. K. Heath* and *J. Polglaze*. International comparisons of the time lost through industrial disputes: *E. J. Riches*. Taxable capacity: *L. F. Giblin*. The third census of the Commonwealth of Australia: *H. C. Green*.

UNION OF SOUTH AFRICA—

South African Journal of Economics, March, 1934—Economic method and the concept of competition: *Professor W. H. Hutt*. Tariffs and economic nationalism: *Townley O. Williams*.

UNITED STATES—

American Academy of Political and Social Science, Annals, March, 1934—Towards national recovery, addresses delivered at the January Conference of the Academy, being a résumé of the work of the N.R.A., with special reference to business, labor, and the consumer. (Whole number.)

American Economic Review—

March, 1934—Economics and the National Recovery Administration: *J. M. Clark*. Budget balancing and economic stabilization: *John B. Canning* and *E. G. Nelson*. Emergency budget of the United States: *J. Wilmer Sundelson*. Concentration of economic power: *W. L. Crum* (with a reply by *Gardiner C. Means*, and a rejoinder by the author).

Supplement, March, 1934—Papers and proceedings of the forty-sixth annual meeting of the American Economic Association. (Whole number.)

UNITED STATES—*Contd.*

American Statistical Association, Journal—

March, 1934—Statistical opportunities and responsibilities: *Stuart A. Rice*. A random-difference series for use in the analysis of time series: *Holbrook Working*. Derivation of rates from summation data by the catalytic curve: *Hugo Muench*. The analysis of multiple classifications with unequal numbers in the different classes: *F. Yates*. Meeting of the International Statistical Institute at Mexico City: *Walter F. Willcox*. Some fundamental factors entering into the wealth and income of the United States: *L. C. Wilcoxon*.

Supplement, March, 1934—Whole number on the proceedings of the ninety-fifth annual meeting of the American Statistical Association, including papers on: The industrial and commercial area vs. the political area as the unit for the collection of business statistics. Some problems in the construction of an index-number of rents: *Jacob Perlman* (with discussion). Changes in family income and rental during the economic depression: *Edgar Sydenstricker* and *G. St. J. Perrott*. The economic depression and sickness: *Selwyn D. Collins* and *G. St. J. Perrott*. Problems in the application of correlation to sociology: *Samuel A. Stouffer*. The inadequacy of correlation method in genetic research: *B. Sanders*. Estimates of unemployment during the last four years: *Theodore J. Kreps*. The reliability of various statistical series as city and regional business indexes. Revising the wage-earners' cost-of-living index: *Margaret H. Hogg*. Adequacy of the sample in budgetary studies: *Hugh S. Hanna*.

International Conciliation, April, 1934—Self-sufficiency, some random reflections: *Walter Lippmann*. Planning international trade: *G. D. H. Cole*.

Milbank Memorial Fund Quarterly—

January, 1934—Health insurance in Europe: *G. F. McCleary*. Diets of low-income families in Cleveland, Detroit, and Syracuse: *Dorothy G. Wiehl*. Tuberculosis in a rural population: *John H. Korn*. A study of the Chinese population: *Chi-ming Chiao*.

April, 1934—Medical care during the depression: *Edgar Sydenstricker* and *Selwyn D. Collins*. The present and future organization of medicine: *I. S. Falk*. Sickness, unemployment, and differential fertility: *Edgar Sydenstricker* and *G. St. J. Perrott*. Tuberculosis case-finding in the Red Hook area of New York City: *Jean Downes*.

Quarterly Journal of Economics, February, 1934—Labor under the German Republic: *William T. Ham*. Guaranty of deposits under the Banking Act of 1933: *Guy Emerson*. The price of silver and Chinese purchasing power: *T. J. Kreps*. Prices under competition and monopoly, some concrete examples: *Vernon A. Mund*. Adam Smith, America, and the doctrinal defeat of the mercantile system: *C. R. Fay*.

UNITED STATES—*Contd.*

Record, October, 1933—Interpolation formulas in terms of function values rather than differences: *J. F. Reilly*. Mortality experience under extended-term and paid-up provisions and a general method of obtaining mortality experience after a change in the status of a policy: *James S. Elston*.

Review of Economic Statistics—

February, 1934—British and French economic conditions: (communicated). Gold and prices (statistical tables): (communicated).

March, 1934—General economic conditions in the United States: editorial. British, French, and German conditions: (communicated). Measuring business fluctuations, the B curve: editorial. The agricultural situation, February, 1934: *John D. Black*. The course of corporation profits: *W. L. Crum*.

Wheat Studies of the Food Research Institute, Stanford University—

January, 1934—World wheat survey and outlook, January, 1934.

February, 1934—Price relations between May and new-crop wheat futures at Chicago since 1885.

March, 1934—Environment, heredity, and wheat quality.

ARGENTINA—

Revista de Ciencias Económicas—

November, 1933—La vialidad en la República Argentina, su evolución y estado actual, I and II: *Teodoro Sanchez de Bustamante*.

December, 1933—La vialidad en la República Argentina, su evolución y estado actual, III: *Teodoro Sanchez de Bustamante*.

BELGIUM—

Revue du Travail, February, 1934—La fixation des prix du commerce: *G. de Leener*.

CHINA—

Monthly Bulletin on Economic China, January, 1934—Economic statistics in China: *H. D. Fong*.

Quarterly Journal of Economics and Statistics, September, 1933—Rural industries in China: *H. D. Fong and Chih Wu*. Iron and steel industry in China: *Y. T. Ku*. [Chinese text.]

DENMARK—

Nationaløkonomisk Tidsskrift, Hefte 1, 1934—Nogle Træk af de forenede Staters nye økonomiske Politik: *Arel Nielson*. Foranstaltninger mod Arbejdsløsheden i de Nordiske Lande i Depressionsaarene 1931–33: *O. Blinkenberg Nielsen*. "Hvor Glider vi Hen?": *C. V. Bramsnaes*.

EGYPT—

L'Égypte Contemporaine—

May–November, 1933—Catalogue de la Bibliothèque de la Société Royal d'Économie Politique, de Statistique et de Législation. (Whole number.)

December, 1933—A statistical study of the population of Egypt : *H. El S. Azmi.*

January–February, 1934—Les débuts de la législation sociale Égyptienne; lois nos. 48 et 80 réglementant le travail des enfants et des femmes : *I. G. Levi.* Le développement du commerce de l'Égypte (suite) : *Jean Schatz.*

FRANCE—

Bulletin de la Statistique Générale de la France, January, 1934—

Quelques données statistiques sur l'Indochine française : *Henri Ulmer.*

Revue d'Économie Politique—

November–December, 1933—Le problème autrichien : *Victor Kienboeck.* Les émissions d'emprunts au-dessous du pair : *André Marchal.* La vie économique aux États-Unis : *Pierre Meynial.*

January–February, 1934—Fluctuations économiques et rendements fiscaux : *Henry Laufenburger.*

Journal des Économistes—

February, 1934—États-Unis et Grande-Bretagne : *R. J. Pierre.* La Ville libre et le Port de Dantzig : *C. de Kownacki.*

March, 1934—Les chemins de fer en Belgique et aux Pays-Bas : *R. J. Pierre.* Considérations monétaires : *Michel Carsow.*

Journal de la Société de Statistique de Paris—

February, 1934—Progrès et avenir de l'automobile : *Alfred Sauvy.* Sur les taux de stabilisation d'une population : *Alfred Sauvy* (with a note by *Adolphe Landry*). Crise économique et mouvement de la population : *Alfred Sauvy.*

March, 1934—Quelques observations sur un mode de notation du chômage partiel, sur les salaires et sur la productivité ouvrière dans les Houillères du Nord de la France de 1923 à 1932 : *M. Rousseau.*

April, 1934—La technique de l'assurance et la distribution du crédit par les banques : *C. Penglaou.* La surpopulation des universités et écoles supérieures et la tâche de la statistique : *Philip J. Idenburg.*

GERMANY—

Blätter für Versicherungs-Mathematik und verwandte Gebiete, April, 1934—Belastete Integralgleichung für die Aktien-Ordnung in der Invalidenversicherung : *Otomar Pankraz.* Die Risiko-zwischenversicherung : *Heinrich Jecklin.*

GERMANY—*Contd.*

Vierteljahrshefte zur Konjunkturforschung, Sonderheft 35, 1934—
Die Getreidewirtschaft Preussens von 1800 bis 1930.

Weltwirtschaftliches Archiv—

January, 1934—Staatsraum und Wirtschaftsraum: Andreas Predöhl. Grundsätzliches zur Messbarkeit der Nachfrageelastizität: A. de Graaff. Die Goldbewegungen nach Frankreich in den letzten Jahren: Sudhir Sen.

March, 1934—Zur Psychologie der Weltwirtschaft und ihrer Krisis: Dr. Erwin Wiskemann. Der Donauraum in der Weltwirtschaft: Elemér Hantos. Der Automatismus der Goldwährung: Eraldo Fossati. Die Goldbewegungen aus Britisch-Indien: Sudhir Sen. Japans Erdölversorgung und Erdölpolitik: Herbert Rosinski. Die Wirtschaftsstruktur Chinas und die Politik der Nanking-Regierung: Sau-Mu Liang.

Zeitschrift für die Gesamte Versicherungs-Wissenschaft, April, 1934—

Die Lebensversicherung im nationalsozialistischen Staat: Walther Rohrbeck. Landarbeiter und Sozialversicherung in Italien: Luigi Clerici.

HUNGARY—

Journal de la Société Hongroise de Statistique, Nos. 3-4, 1933—À la mémoire de Charles Keleti, 1833-1933: B. Földes. Les récents progrès de la statistique internationale des Grandes Villes: G. Thirring. Influence des conditions économiques sur le mouvement de la population en égard spécialement à la Hongrie: Theodore Szel. Les budgets et les finances de l'État hongrois depuis l'assainissement financier: A. Hajdrik. L'industrie et la politique industrielle de la France depuis 1870 jusqu'en 1914: Z. Guothfalvy Dorner.

ITALY—

Le Assicurazioni Sociali—

N. 6, 1933—Il risanamento delle assicurazioni sociali per le pensioni in Germania: S. E. Franz Seldte. Il costo della disoccupazione: Prof. Federico Chessa. La riforma sociale in Danimarca: R. Lassen. [A Supplement contains these articles in German, French, and English respectively.]

N. 1, 1934—Legge corporativa e legge sociale: Prof. Gino Arias. La costituzione degli enti d'assicurazione nell'assicurazione malattia obbligatoria: A. Tixier. L'assicurazione scolastica nella Svizzera e a Ginevra in particolare: Charles H. Weber.

ITALY—Contd.

Economia, February, 1934—A proposito di statistica economica corporativa: *Livio Livi*. La crisi dell' economia: *Gini Arias*. La crisi dell' economia austriaca nel dopoguerra: *Aristide Landi*.

La Riforma Sociale, January–February, 1934—Per la ripresa delle esperiazioni: *Giovanni Agnelli*. Debiti: *Luigi Einaudi*. 50, o 60? Nel centenario di vita del dollaro: *Attilio Cabiati*. In difesa della scienza delle finanze: *Luigi Einaudi*.

Giornale degli Economisti e Rivisti di Statistica, January, 1934—Dall'automatismo economico al corporativismo: *Bruno Biagi*. I problemi dell'esportazione e della politica commerciale: *Alberto Asquini*.

Giornale dell' Istituto Italiano degli Attuari, January, 1934—Su un teorema relativo alla legge uniforme dei grandi numeri: *H. Cramér*. L'età limite: *E. J. Gumbel*.

Rivista Italiana di Statistica, Economia e Finanza, February, 1934—Tradizione e rivoluzione nella vita economica: *A. De' Stefani*. Il corporativismo e la scienza economica: *F. Vinci*.

JAPAN—

Kyoto University Economic Review, December, 1933—On the textiles consumption tax: *Professor M. Kambe*.

POLAND—

Revue Trimestrielle de Statistique, Fasc. 4, 1933—Le problème des membres de famille coactifs dans la statistique des professions: *Dr. Rajmund Buławski*. La réponse aux "observations critiques au sujet d'une des théories mathématiques de la conjoncture" de M. A. Rajchman: *M. Kalecki*.

SWEDEN—

Ekonomisk Tidskrift—

Häft 5–6, 1933—Spridda studier angående stagnationens nationalekonomi: *David Davidson*.

Häft 1, 1934—Vår yrkesfördelning och dess utveckling: *Gustaf Åkerman*.

INTERNATIONAL—

International Labour Review, March, 1934—The regulation of collective employment relations in agriculture in Italy: *H. E. Bruno Biagi*. Collaboration between placing and unemployment insurance institutions: *Marguerite Schoeler*.

Revue de l'Institut International de Statistique, Livr. 1, 1934—Taux globaux et taux composites en démographie: *L. Hersch* (avec résumé anglais). Growth of world trade versus basic production: *C. Snyder* (avec résumé français). Les recherches relatives à la Conjoncture au Bureau Central de Statistique des Pays-Bas: *H. W. Methorst and J. Tinbergen*.

INTERNATIONAL—Contd.

Metron—

- Vol. XI, N. 1—Über die Berechnung des Schwerpunkts und der Trägheitsellipse einer Bevölkerung: *F. J. Linders*. The centre of population for various continuous distributions of population over areas of various shapes: *F. L. Griffin*. Sulla determinazione del centro di gravità e del centro mediano di una popolazione con applicazioni alla popolazione italiana censita il 1° dicembre 1921: *L. Galvani*. Locating the median of the population in the United States: *Douglas E. Scates*. Altri risultati delle indagini sulle famiglie numerose: *C. Gini* and *A. Ferrarelli*. Sulla nuzialità differenziale delle varie classi sociali: *C. Gini*. Un nuovo fattore di selezione matrimoniale? L'ordine di generazione: *C. Gini*. Le développement de la population belge depuis 1930: *Tilla Vulhopp*. Die natürliche Lebensdauer des Menschen und ihre statistische und individuelle Beurteilung: *F. Bernstein*.
- Vol. XI, N. 2—Sui centri della popolazione e sulle loro applicazione: *C. Gini*, *M. Boldrini*, *L. Galvani*, and *A. Venere*. Anpassung von Flächen an zweidimensionale Kollektivgegenstände und ihre Auswertung für die Korrelationstheorie: *E. Merzrath*.
- Vol. XI, N. 3—La intensità della diminuzione della fecondità matrimoniale secondo l'età della madre: *C. Gini*. La mortalità per malattie puerperali: Istituto Centrale di Statistica del Regno d'Italia. Der Einfluss der jüdischen Einwanderung auf die ökonomische Entwicklung Palästinas: *W. Preuss*.

LIST OF ADDITIONS TO THE LIBRARY.

Since the issue of Part I, 1934, the Society has received the publications enumerated below :—

I.—OFFICIAL PUBLICATIONS.

(a) United Kingdom and its several Divisions.

United Kingdom—

Adelphi Estate Act, 1933. 23 and 24 Geo. 5, Chapter lxxxviii. An act to repeal certain statutory restrictions upon the use of part of the Adelphi Estate to authorise the widening of certain existing streets and the construction of new streets and the stopping up of an existing street on the estate and for other purposes. 28th July, 1933. London: H.M.S.O., 1933. 9½" × 6"; 40 pp. 1s. 6d.

Customs and Excise, Board of. Customs and Excise tariff of Great Britain and Northern Ireland in operation on the 1st January, 1934. London: H.M.S.O., 1934. 8½" × 5½"; 271 pp. 9d.

General Register Office—

Census of England and Wales, 1931. County of Somerset (Part II). 23 pp. County of Surrey (Part II). 25 pp. London: H.M.S.O., 1934. 13½" × 8½"; 2 parts. 1s. 3d. each.

Registrar-General's decennial supplement, England and Wales, 1931. Part III. Estimates of population, statistics of marriages, births and deaths, 1911–1920. London: H.M.S.O., 1933. 13½" × 8½"; clxxviii + 507 pp. 30s.

Health, Ministry of—

Departmental Committee on Sterilisation, Report. Cmd. 4485. 137 pp. 2s.

Departmental Committee on Qualifications, Recruitment, Training and Promotion of Local Government Officers, Report. 91 pp. 1s. 6d.

Rating and Valuation Acts 1925 to 1932. Consolidated and amended edition of the first eight series of representations received by the Minister of Health from the Central Valuation Committee . . . and circulated by the Minister to local authorities. 123 pp. 1s.

[London: H.M.S.O., 1934. 9½" × 6".]

Medical Research Council—

Special report series. 190: A study of growth and development: observations in successive years on the same children, by R. M. Fleming, with a statistical analysis by W. J. Martin. 85 pp. 1s. 6d. 192: Housing conditions and respiratory disease; morbidity in a poor-class quarter and in a rehousing area in Glasgow, by C. M. Smith. 36 pp. 9d.

[London: H.M.S.O., 1933–34. 9½" × 6".]

Overseas Trade, Department of—

Reports: 565. Union of South Africa, September, 1933. 74 pp. 2s. 566. El Salvador, November, 1933. 43 pp. 1s. 9d. 567. Uruguay, 1933. 48 pp. 1s. 6d. 568. Switzerland, December, 1933. 63 pp. 2s. 569. Finland, 1933. 79 pp. 2s. 6d. 570. Mexico, November, 1933. 36 pp. 1s. 571. Costa Rica, 1929–1933. 36 pp. 1s. 572. Paraguay, 1933. 43 pp. 1s. 6d.

[London: H.M.S.O., 1934. 9½" × 6".]

Trade, Board of. Final report on the Fourth Census of Production (1930). Part II. The iron and steel trades, the engineering, shipbuilding and vehicle trades, the non-ferrous metal trades. London: H.M.S.O., 1934. 9½" × 6"; xviii + 506 pp. 7s. 6d.

(a) United Kingdom and its several Divisions—*Contd.*

Scotland—

Agriculture, Department of. Agricultural output of Scotland, 1930. Report on certain statistical inquiries made in connection with the Census of Production relating to the output of agricultural produce. Edinburgh: H.M.S.O., 1934. 9 $\frac{1}{2}$ " \times 6"; 79 pp. 1s. 3d.

Fishery Board for Scotland. Fecundity of the haddock. By D. S. Rait. (Fisheries, Scotland, Sci. Invest., 1932, No. 1.) Edinburgh: H.M.S.O., 1933. 10 $\frac{1}{2}$ " \times 7 $\frac{1}{2}$ "; 42 pp. 2s. 6d. (From the author.)

Health, Department of—

Report of the Scottish Departmental Committee on Housing. Cmd. 4469. Edinburgh: H.M.S.O., 1933. 9 $\frac{1}{2}$ " \times 6"; 93 pp. 1s. 6d.

Report on incapacitating sickness in the insured population of Scotland during the year 1st July, 1931 to 30th June, 1932. Edinburgh: H.M.S.O., 1934. 9 $\frac{1}{2}$ " \times 6"; 40 pp. 9d.

Scottish Office. Police consolidation (Scotland) Committee, Report. Cmd. 4463. Edinburgh: H.M.S.O., 1934. 9 $\frac{1}{2}$ " \times 6"; 28 pp. 6d.

(b) Dominions, Colonies, and Protectorates.

Canada—

Dominion Bureau of Statistics. Canada, 1934: the official handbook of present conditions and recent progress. Ottawa, 1934. 8 $\frac{1}{2}$ " \times 5 $\frac{1}{2}$ "; 192 pp.

Mauritius—

Final report on the census enumeration made in the Colony of Mauritius and its Dependencies on April 26th, 1931. Port Louis, 1933. 13" \times 8"; 20 + lxiii pp.

Sudan—

Annual report of the Secretary for Economic Development, and statistics of foreign trade, 1932-33. Khartoum (London, Sudan Government Offices), 1933. 9 $\frac{1}{2}$ " \times 7 $\frac{1}{4}$ "; 244 pp. (From Mr. H. T. Curwen.)

(c) Foreign Countries.

Argentina—

Santa Fé. Dirección General de Estadística. Zonas agropecuarias de la Provincia de Santa Fé. Santa Fé, 1933. 10 $\frac{1}{4}$ " \times 6 $\frac{1}{4}$ "; 80 pp.

Germany—

Statistisches Reichsamt—

Das deutsche Volkseinkommen vor und nach dem Kriege. (Einzelschriften zur Statistik des deutschen Reichs Nr. 24.) Berlin, 1934. 11 $\frac{1}{4}$ " \times 8 $\frac{1}{2}$ "; 196 pp.

Statistik des deutschen Reichs. Band 438. Das Schulwesen im deutschen Reich: Schuljahre 1931-32. 239 pp. Band 450. Amtliches Gemeindeverzeichnis für das deutsche Reich auf Grund der Volkszählung 1933. 366 pp. Berlin, 1933-34. 12" \times 8 $\frac{1}{2}$ ".

Vorläufige Ergebnisse der Volks-Berufs- und Betriebszählung vom 16 Juni 1933. Einwohnerzahlen, Stadt- und Landbevölkerung, Wanderungsbilanz, Haushaltungen, Leerstehende Wohnungen, Landwirtschaftliche Betriebe. (Sonderhefte zu *Wirtschaft und Statistik* No. 12.) Berlin, 1934. 11 $\frac{1}{2}$ " \times 8 $\frac{1}{2}$ "; 72 pp. 1.50 Rm.

(c) Foreign Countries—*Contd.***Italy—**

Istituto Centrale di Statistica. Censimento generale della popolazione . . . 1931—

Vol. II. Popolazione dei comuni e delle frazioni di censimento. Parte III. Elenco alfabetico dei comuni e delle frazioni di censimento.

Vol. III. Fasc. 1-4, 6-9, 11, 13-67, 69-70, 73-74, 76-77, 80, 82, 84-85, 87, 91.

[Rome, 1933-34. 12" × 9".]

Norway—

Statistiske Centralbyrå—

Folketellingen i Norge 1 desember 1930. Femte hefte. Folkemengden fordelt efter kjønn, alder og ekteskadelig stilling. Oslo, 1934. 10" × 6½"; 18 + 44 pp.

Stortingets Kontor. Stortingsvalget 1933. Oslo, 1934. 9½" × 6¼"; vi + 169 pp.

Poland—

Office Central de Statistique. Statistique de la Pologne, Série B. 16. Endettement des villes et des unions communales d'arrondissements. Situation au 31.III.1931. 75 pp. 23. Répartition des credits bancaires en Pologne 1931-1932. 34 pp. 24. Projets des budgets des administrations autonomes pour l'année 1933-34. 45 pp. Série C. 1a. Statistique industrielle 1932. Partie 1. 123 pp.

[Warsaw, 1934. 10½" × 8¼".]

Polish Tobacco Monopoly. Polski Monopol Tytoniowy, 1919-1925. 180 pp. 1926-1927. 91 pp. Sprawozdanie z działalności za lata 1927-28 i 1928-29. 111 pp. Warsaw, 1926-1931. 11" × 8½"; 3 parts.

Mozambique—

República de Estatística. Boletim economico e estatístico, Jan. 1933. Lourenço Marques, 1933. 10½" × 7½"; 89 pp.

Russia—

Internationales Agrarinstitut U.S.S.R. Agrar-Probleme. Band 5, Hefte 1-2 (1934). Moscow, 1934. 9" × 6"; 361 pp.

Saar Basin—

Statistisches Amt. Bericht des statistischen Amtes des Saargebietes. Heft 5, 1927. Saarbrücken, 1927. 10" × 7½"; 244 pp.

Spain—

Dirección General del Instituto Geografico Catastral y de Estadística. Boletín del Centro de Investigaciones Especiales o Laboratorio de Estadística. Información Estadística sobre la Industria y Comercio de Carbones (Suplemento al Boletín num. 8 del 1 de enero). Madrid, 1934. 10½" × 7½"; 110 pp. + iv charts.

Dirección General de Sanidad—

La mortalidad infantil en España, por M. Pascua. Madrid, 1934. 9½" × 6½"; 120 pp.

Mortalidad en España por rúbricas de la Lista internacional abreviada causas de defunción y algunos otros indices de movimiento de población, por M. Pascua. Madrid, 1934. 9½" × 6½"; 20 pp.

Switzerland—

Bureau Fédéral de Statistique. Recensement fédéral de la population . . . 1930. Vol. 9. Kanton Bern. 255 pp. Vol. 10. Canton de Vaud. 219 pp. Bern, 1934. 11½" × 8¼".

Bern. Mitteilungen des Statistischen Bureaus des Kantons Bern. 14. Die Bindungen im bernischen Gastwirtschaftsgewerbe . . . 1933. 108 pp. 15. Die Ergebnisse der eidgenössischen Rindvieh- Schweine- und Pferde- zählung vom 21 April 1933, und der eidgenössischen repräsentativen Schweinezählung vom 20 Nov. 1933. 52 pp. Bern, 1933. 9½" × 6½"; 2 parts.

(c) Foreign Countries—Contd.

United States—

Agriculture, Department of—

Agricultural Adjustment Administration. Analysis of the corn-hog situation, November, 1933. Washington, 1933. 9" × 6"; 17 pp.

Miscellaneous publications. 158. Handbook of poultry and egg statistics. 6½" × 4"; 105 pp. 10 c. 171. The crop and live-stock reporting service of the United States. 11¼" × 9¼"; 104 pp. 15 c. 182. The agricultural outlook for 1934. 9" × 6"; 110 pp.

[Washington, 1934.]

Technical bulletin 378. Commercial possibilities of Japanese mint in the United States as a source of natural menthol. Washington, 1933. 9" × 6"; 17 pp.

Children's Bureau. Publication 197. Child labor: facts and figures. Washington, 1933. 9" × 6"; 85 pp. 10 c.

Education, Office of. Bulletins. 12. The education of native and minority groups, a bibliography, 1923-1932. 57 pp. 5 c. 13. High-school instruction by mail: a potential economy. 69 pp. 10 c. 14. The effects of economic depression on education in other countries. 37 pp. 5 c.

[Washington, 1933. 9" × 6".]

Labor Statistics, Bureau of. Bulletins. 591. Wages and hours of labor in the hosiery and underwear industries 1932. 98 pp. 10 c. 593. Technological changes in the electric lamp industry. 62 pp. 10 c. 594. Wages and hours of labor in the men's clothing industry: 1932. 65 pp. 10 c.

[Washington, 1934. 9" × 6".]

Women's Bureau. Bulletins. 106. Household employment in Chicago. 62 pp. 10 c. 113. Employment fluctuations and unemployment of women: certain indications from various sources 1928-31. 236 pp. 15 c.

[Washington, 1933. 9" × 6".]

(d) International.

International Labour Office—

Studies and Reports—

Series B. No. 19. National recovery measures in the United States. 224 pp. 3s. 6d.

Series M. No. 11. International survey of social services. xxiii + 688 pp. 15s.

[Geneva (London: P. S. King), 1933. 9½" × 6¼".]

Employment exchanges: an international study in placing activities. Geneva (London: P. S. King), 1933. 9½" × 6¼"; iv + 231 pp. 5s.

Wages, hours of work, and other factors in the remuneration of workers in certain towns in October, 1932. International statistics of rents in certain towns in 1932. Geneva: Reprint from *International Labour Review*, 1933. 9½" × 6¼"; 79 pp. 2s.

International Labour Office and International Institute of Agriculture—

Studies on movements of agricultural population: 1. The rural exodus in Germany: results of an investigation made in May, 1931, by Dr. H. Böker and F. W. von Bulow in the Provinces of Pomerania and Saxony and in the Free State of Saxony. Geneva (London: P. S. King), 1933. 9½" × 6¼"; 137 pp. 3s. 6d.

League of Nations—

Economic and Financial Section—

Commercial banks, 1925-1933. Geneva (London: Allen and Unwin), 1934. 10½" × 8½"; 336 pp. 10s.

Double taxation and fiscal evasion: collection of international agreements and internal legal provisions for the prevention of double taxation and fiscal evasion, Vol. V. Geneva, 1933. 10" × 7½"; 136 pp.

II.—AUTHORS AND MISCELLANEOUS.

- Abbati (A. H.)*. Unclaimed Wealth Utilization Committee, Geneva. Economic readjustment in 1933; third series of bulletins issued under the chairmanship of A. H. Abbati. London: P. S. King, 1934. $8\frac{1}{2}'' \times 5\frac{1}{2}''$; xiii + 102 pp. 6s.
- Bigo (Robert)*. Les bases historiques de la finance moderne. Paris: Armand Colin, 1933. $6\frac{1}{2}'' \times 4\frac{1}{2}''$; 216 pp. fr. 10.50.
- Bowman (Raymond T.)*. A statistical study of profits. Philadelphia: University of Pennsylvania Press, 1934. $9'' \times 6''$; xvii + 322 pp. \$3.
- Carnegie Endowment for International Peace. International conciliation. Documents for the year 1933. Worcester, Mass., 1933. $7\frac{1}{2}'' \times 5''$; 551 pp. (From the Carnegie Endowment.)
- Ceylon Economic Society. The Ceylon Economic Journal, Vol. V. December, 1933. Colombo: Ceylon University College, 1934. $9\frac{1}{2}'' \times 6''$; 63 pp.
- Chow (Felton)*. Railroad warehousing service. Philadelphia: University of Pennsylvania Press, 1931. $9\frac{1}{2}'' \times 6''$; 241 pp.
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Imports.—Declared value of merchandise imported into the United Kingdom in the years ended December 31, 1931, 1932, 1933.

Countries from which consigned.	1931.	1932.	1933.
	£'000.	£'000.	£'000.
Russia	32,286	19,645	17,436
Finland	11,630	11,733	12,771
Sweden	17,342	13,424	15,953
Norway, including Spitzbergen	8,630	8,283	6,956
Denmark,* including Faroe Islands	46,696	40,570	35,424
Poland, including Dantzic	8,612	6,184	6,551
Germany	64,162	30,499	29,818
Netherlands *	35,199	22,030	18,590
Java	4,556	4,717	3,409
Belgium *	33,190	16,023	12,915
France *	40,922	19,070	19,085
Switzerland	11,362	5,178	5,218
Portugal *	3,309	2,586	2,726
Spain *	14,249	12,501	11,275
Italy *	15,148	10,763	9,234
Czechoslovakia	6,620	3,041	2,890
Greece (excluding Crete)	2,026	2,340	2,065
Roumania	3,412	3,450	4,167
Turkey, European and Asiatic, including Smyrna and Armenia	1,475	1,617	1,151
Egypt	10,841	10,388	12,392
China †	7,773	6,163	5,131
Japan ‡	6,952	6,695	7,228
United States	104,009	83,632	75,790
Cuba	4,292	5,334	4,302
Mexico	2,397	2,430	2,534
Peru	3,510	4,405	4,711
Chile	4,483	3,896	3,759
Brazil	5,704	4,049	4,809
Uruguay	5,230	3,003	3,462
Argentine Republic... ..	52,744	50,885	41,691
Other Countries	45,085	38,999	42,937
<i>Total—Foreign Countries</i>	613,837	453,533	426,388
BRITISH POSSESSIONS.§			
Irish Free State	36,547	26,542	17,784
British West Africa	4,891	5,599	5,779
Union of South Africa	13,133	15,640	14,532
British East Africa	3,669	3,650	4,196
British India, with Burma	36,711	32,308	37,392
Straits Settlements and Federated Malay States	6,453	4,777	4,635
Ceylon and Dependencies	11,996	10,320	9,108
Australia	45,679	45,992	48,606
New Zealand	37,775	37,019	37,183
Canada	32,840	42,994	46,218
British W. Indies, with Bahamas... ..	4,389	5,487	5,818
Other Possessions	13,333	17,809	18,208
<i>Total—British Possessions</i>	247,416	248,137	249,459
<i>Total—Foreign Countries and British Possessions</i>	861,253	701,670	675,847

* Excluding colonies.

† Excluding Hong Kong, Macao and leased territories.

‡ Including Formosa and leased territories.

§ Including Protectorates and Mandated Territories.

Exports: Declared value of U.K. Produce and Manufactures, and of Imported Merchandise, exported from the United Kingdom in the years ended December 31, 1931, 1932, 1933.

Countries to which consigned.	1931.		1932.		1933.	
	Exports.	Re-exports.	Exports.	Re-exports.	Exports.	Re-exports.
	£'000.	£'000.	£'000.	£'000.	£'000.	£'000.
Russia	7,291	1,912	9,223	1,397	3,284	973
Finland	1,604	170	2,263	242	2,846	257
Sweden	7,744	719	6,885	667	7,172	674
Norway	7,559	301	5,802	340	5,552	261
Denmark,* with Faroe Islands	8,657	557	9,853	499	11,795	477
Poland, including Dantzig ...	2,004	574	2,001	668	2,740	1,108
Germany	18,412	13,590	14,575	10,812	14,712	9,778
Netherlands*	13,701	2,998	12,106	2,383	12,480	1,975
Java	2,507	84	2,458	47	2,147	45
Belgium*	10,025	4,547	8,678	4,131	8,836	4,089
France*	22,552	9,468	18,446	8,332	18,159	7,624
Switzerland	4,138	853	3,706	737	3,947	634
Portugal*	2,455	204	2,585	183	3,501	120
Spain*	5,294	222	5,224	354	4,404	214
Italy,* including Fiume ...	9,917	727	8,639	786	9,050	883
Czechoslovakia... ..	1,337	127	962	117	860	151
Greece	3,179	136	2,178	124	1,946	107
Roumania	1,333	29	1,757	32	2,384	58
Turkey, European and Asiatic, incl. Smyrna and Armenia...	1,715	66	1,482	51	1,458	63
Egypt	6,650	158	6,510	132	6,265	184
China †	7,859	115	7,838	88	6,301	113
Japan †	6,187	145	5,730	109	4,428	152
United States	18,246	7,967	15,091	5,733	19,053	7,052
Cuba	656	18	701	23	596	7
Mexico	943	35	1,089	19	1,416	15
Peru	664	41	728	36	897	35
Chile	1,932	216	663	106	731	25
Brazil	4,063	106	4,679	152	6,166	153
Uruguay	1,985	33	1,501	26	1,750	24
Argentine Republic	14,785	270	10,660	202	13,083	214
Other Countries	24,555	1,416	25,499	963	35,840	1,171
<i>Total—Foreign Countries</i>	219,949	47,804	199,512	39,490	203,880	38,636
BRITISH POSSESSIONS.						
Irish Free State	30,511	8,538	25,784	6,079	19,010	4,650
British West Africa	6,321	643	7,914	634	6,392	498
Union of South Africa	21,931	1,075	18,172	520	23,393	616
British East Africa	3,001	84	2,267	56	2,192	67
British India with Burma	32,289	801	34,088	584	33,397	689
Straits Settlements and Federated Malay States ...	6,282	199	5,653	135	5,345	117
Ceylon and Dependencies ...	2,703	117	2,485	70	2,130	71
Australia	14,528	625	20,020	592	21,322	736
New Zealand	11,196	535	10,358	288	9,545	257
Canada	20,551	1,600	16,412	974	17,510	1,112
Brit. W. Indies, with Bahamas	3,876	299	4,620	218	4,633	170
Other Possessions	17,484	1,547		1,381	18,666	1,458
<i>Total—British Possessions ...</i>	170,673	16,063	165,512	11,531	163,535	10,441
Total—Foreign Countries and British Possessions ...	390,622	63,868	365,024	51,021	367,414	49,078

* Excluding colonies.

† Excluding Hong Kong, Macao, and leased territories; including Weihaiwei.

‡ Including Formosa and leased territories; excluding Korea.

REGISTRATION OF THE UNITED KINGDOM.

No. I.—ENGLAND AND WALES.

A.—Serial Table of BIRTHS, DEATHS and MARRIAGES, returned in the Years 1927–1933, and in the QUARTERS of those Years.

Calendar YEARS, 1927–1933 :—Numbers.

YEARS	1927.	1928.	1929.	1930.	1931.	1932	1933 *
Births	654,172	660,267	643,673	648,811	632,081	613,972	580,850
Stillbirths	—	27,580	26,847	27,577	26,933	26,471	25,028
Deaths	484,609	460,389	532,492	455,427	491,630	484,129	496,550
Marriages	308,370	303,228	313,316	315,109	311,847	307,184	317,394

(I.) LIVE BIRTHS :—Numbers in QUARTERS of each Calendar Year, 1927–1933.

QUARTERS.	1927.	1928.	1929.	1930.	1931.	1932.	1933.
Jan.–Mar. ...	166,974	167,926	160,047	158,545	159,663	152,116	148,675
Apr.–June ...	170,778	170,997	169,451	170,042	163,760	165,403	154,165
July–Sept. ...	163,854	165,675	163,777	165,596	161,133	156,186	148,085
Oct.–Dec.	152,566	155,689	150,398	154,628	147,525	140,267	129,925

(II.) STILLBIRTHS :—Numbers.

QUARTERS.	1927.	1928.	1929.	1930.	1931.	1932.	1933.*
Jan.–Mar. ...	—	7,077	6,878	7,069	7,091	6,883	6,675
Apr.–June ...	—	7,126	6,937	7,098	6,940	7,152	6,652
July–Sept. ...	6,198	6,617	6,569	6,850	6,568	6,283	5,887
Oct.–Dec.	6,388	6,760	6,463	6,560	6,334	6,153	5,814

(III.) DEATHS :—Numbers.

QUARTERS.	1927.	1928.	1929.	1930.	1931.	1932.	1933.*
Jan.–Mar. ...	168,760	136,299	204,309	131,967	162,208	153,451	170,002
Apr.–June ...	107,595	114,742	118,728	111,336	114,694	116,228	108,609
July–Sept. ...	92,238	93,715	96,749	96,389	96,735	97,984	95,842
Oct.–Dec. ...	116,016	115,633	112,706	115,735	117,993	116,466	122,097

(IV.) MARRIAGES :—Numbers.

QUARTERS.	1927.	1928.	1929.	1930.	1931.	1932.	1933.
Jan.–Mar. ...	47,940	45,250	54,426	48,825	46,574	62,315	44,233
Apr.–June ...	84,963	84,788	75,488	88,138	85,380	68,968	85,264
July–Sept. ...	91,888	94,478	100,669	98,392	99,415	94,917	102,868
Oct.–Dec.	83,579	78,712	82,733	79,754	80,478	80,984	85,029

* Provisional.

Annual Rate of BIRTHS, DEATHS and PERSONS MARRIED, per 1,000 PERSONS LIVING in the Years 1926-1933, and in the QUARTERS of those Years.

Calendar YEARS, 1926-1933 :—General Ratios.

YEARS. . . .	1926.	1927.	1928.	1929.	1930.	1931.	1932.	1933.*
Estd. Popln. } in thousands } in middle of } each Year }	39,067,	39,210,	39,452,	39,607,	39,806,	39,988,	40,201,	40,350,*
Live Births ...	17·8	16·6	16·7	16·3	16·3	15·8	15·3	14·4
Stillbirths ...	—	—	0·70	0·68	0·69	0·67	0·66	0·62
Deaths	11·6	12·3	11·7	13·4	11·4	12·3	12·0	12·3
Persons Mar- } ried	14·3	15·7	15·4	15·8	15·8	15·6	15·3	15·7

(I.) BIRTHS :—Ratio per 1,000, in QUARTERS of each Calendar Year, 1926-1933.

QUARTERS.	1926.	1927.	1928.	1929.	1930.	1931.	1932.	1933.
Jan.—Mar. ...	18·1	17·2	17·1	16·4	16·2	16·2	15·2	14·9
Apr.—June ...	18·6	17·4	17·4	17·1	16·4	16·4	16·5	15·3
July—Sept. ...	17·8	16·5	16·7	16·4	16·5	16·0	15·5	14·6
Oct.—Dec. ...	16·7	15·4	15·7	15·1	15·4	14·6	13·9	12·8

(II.) STILLBIRTHS :—Ratio per 1,000.

QUARTERS.	1926.	1927.	1928.	1929.	1930.	1931.	1932.	1933.
Jan.—Mar. ...	—	—	0·72	0·70	0·72	0·72	0·69	0·67
Apr.—June ...	—	—	0·73	0·70	0·72	0·70	0·72	0·66
July—Sept. ...	—	0·63	0·67	0·66	0·68	0·65	0·62	0·58
Oct.—Dec.	—	0·65	0·68	0·65	0·65	0·63	0·61	0·57

(III.) DEATHS :—Ratio per 1,000.

QUARTERS.	1926.	1927.	1928.	1929.	1930.	1931.	1932.	1933.*
Jan.—Mar. ...	13·6	17·4	13·9	20·9	13·4	16·5	15·4	17·1
Apr.—June ...	11·7	11·0	11·7	12·0	11·2	11·5	11·6	10·8
July—Sept. ...	9·2	9·3	9·4	9·7	9·6	9·6	9·7	9·4
Oct.—Dec.	12·1	11·7	11·7	11·3	11·5	11·7	11·5	12·0

(IV.) PERSONS MARRIED :—Ratio per 1,00

QUARTERS.	1926.	1927.	1928.	1929.	1930.	1931.	1932.	1933.*
Jan.—Mar. ...	9·6	9·9	9·2	11·1	9·9	9·4	12·5	8·9
Apr.—June ...	16·1	17·3	17·3	15·3	17·8	17·1	13·8	17·0
July—Sept. ...	17·0	18·6	19·0	20·2	19·6	19·7	18·8	20·2
Oct.—Dec.	14·5	16·9	15·9	16·6	15·9	16·0	16·0	16·7

* Provisional figures.

B.—Special Town Table:—POPULATION; BIRTH-RATE and DEATH-RATE (Civilians) in each Quarter of 1933 in certain of the 118 Great Towns.

Cities and boroughs.	Estimated resident population mid-1932.	Annual Rate to 1,000 Living during the thirteen weeks ending							
		March 31, 1933. (1st quarter.)		June 30, 1933. (2nd quarter.)		Sept. 30, 1933. (3rd quarter.)		Dec. 31, 1933. (4th quarter.)	
		Live Births	Deaths†	Live Births	Deaths†	Live Births	Deaths†	Live Births	Deaths†
118 Great towns ...	20,591,505	15.0	17.3	15.3	10.6	14.6	9.1	12.7	12.1
<i>Including—</i>									
London (Met. B.)	4,357,800	13.8	17.3	13.8	10.2	13.2	8.9	11.5	12.0
West Ham C.B.	289,300	16.5	16.5	16.4	9.7	14.9	8.0	13.1	10.9
Croydon C.B. *	237,380	13.4	16.1	14.2	9.2	13.7	7.8	11.1	11.9
Brighton C.B. ...	145,500	14.0	21.0	12.7	11.5	12.6	9.9	11.4	13.6
Portsmouth C.B.	253,100	16.8	18.6	16.5	9.6	14.7	8.8	13.1	11.4
Bristol C.B.*	409,200	13.9	17.5	14.6	10.2	14.2	8.3	12.3	12.1
Cardiff C.B. ...	222,600	15.4	19.7	17.0	10.7	15.2	9.9	14.3	12.3
Swansea C.B. ...	164,900	17.2	17.1	17.0	12.2	16.5	9.6	13.4	12.6
Wolverhampton C.B.*	139,530	16.3	15.9	15.4	9.0	14.4	8.3	13.2	10.9
Birmingham C.B.	1,009,300	16.1	13.3	15.9	9.9	13.3	8.7	13.0	10.9
Norwich C.B. ...	126,600	14.6	17.6	14.0	10.4	14.7	8.7	12.4	13.2
Leicester C.B. ...	240,800	14.4	18.6	14.4	10.2	14.6	9.2	10.7	12.4
Nottingham C.B.*	281,280	16.1	18.0	16.9	11.5	15.7	10.2	14.9	13.4
Derby C.B. ...	142,400	14.4	16.6	13.9	9.7	14.1	8.6	12.1	12.7
Birkenhead C.B.*	151,600	17.6	19.6	16.5	10.6	16.9	9.2	14.2	12.8
Liverpool C.B. ...	859,500	21.2	19.2	20.5	12.6	19.7	10.9	17.7	14.3
Bolton C.B. ...	177,700	12.4	20.5	13.5	12.4	12.2	9.5	9.9	13.2
Manchester C.B.*	762,930	15.4	18.8	15.6	11.6	14.6	9.3	12.9	13.5
Salford C.B. ...	220,300	15.8	18.3	16.0	11.0	14.4	9.5	13.3	13.4
Oldham C.B. ...	138,900	12.3	19.1	13.2	13.3	12.8	10.0	9.5	15.4
Burnley C.B. ...	97,210	11.7	21.1	13.2	12.4	13.7	9.7	9.3	13.9
Blackburn C.B. ...	122,200	12.1	19.6	10.8	13.5	12.4	10.3	9.8	13.1
Preston C.B. ...	118,500	14.5	19.2	16.1	11.8	14.9	9.9	12.8	12.2
Huddersfield C.B.	114,000	11.4	19.4	11.4	13.9	11.9	12.8	10.8	12.7
Halifax C.B. ...	97,700	11.9	20.4	12.2	13.4	11.4	11.1	9.4	15.5
Bradford C.B. ...	206,300	13.6	20.5	13.8	13.4	13.5	10.5	11.7	13.4
Leeds C.B. ...	484,900	14.1	18.7	14.6	12.1	14.6	9.7	11.7	12.9
Sheffield C.B. ...	513,000	14.2	16.7	15.1	9.8	13.9	8.4	12.8	11.2
Kingston-upon-Hull C.B. ...	318,200	18.0	19.9	17.6	11.3	17.4	9.7	16.0	11.2
Sunderland C.B. ...	188,200	20.6	17.4	21.2	13.0	20.1	11.1	16.8	11.8
Gateshead C.B.*	125,070	18.9	18.6	18.4	12.3	18.4	9.3	16.5	11.3
Newcastle-upon-Tyne ...	285,100	17.3	17.7	17.6	11.3	16.9	9.8	14.5	11.5

* Boundary changed Apr. 1, 1933.

† Excluding stillbirths.

Note.—The 118 great towns are those with populations exceeding 50,000 persons at the Census of 1931: before the second quarter of 1927 the figures referred to 105 towns only, from 1927 to 1931 to 107 towns, and in the first quarter of 1932 to 117 towns.

No. II.—SCOTLAND.

BIRTHS, DEATHS AND MARRIAGES IN THE YEAR ENDED DECEMBER 31, 1933.

I.—Serial Table:—Number of BIRTHS, DEATHS and MARRIAGES in Scotland, and their Proportion to the Population estimated to the Middle of each Year, during each Quarter of the Years 1929–1933 inclusive.

	1929.		1930.		1931.		1932.		1933.	
	Number.	Per 1,000.	Number.	Per 1,000.	Number.	Per 1,000.	Number.	Per 1,000.	Number.	Per 1,000.
1st Quarter—										
Births ...	23,440	19·6	23,686	19·6	23,558	19·7	23,069	19·0	21,785	18·0
Deaths ...	26,386	22·1	19,055	15·9	20,189	16·9	19,634	16·2	20,750	17·1
Marriages	6,727	5·0	7,297	6·1	7,075	5·9	7,691	6·3	7,055	5·8
2nd Quarter—										
Births ...	24,380	20·2	24,822	20·5	24,130	20·0	24,245	20·0	23,211	19·0
Deaths ...	15,895	13·1	15,889	13·2	15,916	13·2	16,407	13·5	15,121	12·3
Marriages	8,117	6·7	8,255	6·9	8,157	6·8	7,882	6·5	8,181	6·7
3rd Quarter—										
Births ...	23,053	18·9	22,954	18·8	22,659	18·6	22,033	18·0	21,135	17·1
Deaths ...	13,283	10·0	13,356	10·9	13,244	10·9	13,192	10·7	13,094	10·6
Marriages	9,086	7·0	9,528	7·8	9,353	7·7	9,343	7·6	10,256	8·3
4th Quarter—										
Births ...	21,998	18·0	23,087	18·9	21,873	17·9	21,653	17·6	20,415	16·5
Deaths ...	15,353	12·6	15,985	13·1	14,880	12·2	16,812	13·7	15,883	12·8
Marriages	5,437	6·9	8,205	6·7	8,084	6·6	8,262	6·7	8,723	7·0
Year—										
Population	4,832,000		4,826,000		4,842,554		4,880,000		4,916,000	
Births ...	92,880	1·2	94,549	1·9	92,220	1·9	91,000	1·8	86,546	1·7
Deaths ...	70,917	14·0	64,285	13·3	64,229	13·3	66,045	13·5	64,848	13·2
Marriages	32,907	6·8	33,815	6·9	32,652	6·7	33,178	6·8	34,215	7·0

II.—*Number of Births, Deaths, and Marriages in the 263 Large Burghs and Other Districts of SCOTLAND and their proportion to the population during each quarter of 1933.*

		Births.		Deaths.		Marriages.	
		Number.	Annual rate per 1,000 persons.	Number.	Annual rate per 1,000 persons.	Number.	Annual rate per 1,000 persons.
<i>1st quarter—</i>							
Large Burghs	...	12,319	18·6	11,487	17·3	4,491	6·8
includ- { Glasgow	...	5,471	20·0	4,558	16·6	1,980	7·2
ing { Edinburgh	...	1,702	15·3	1,875	16·8	774	6·9
Dundee	...	793	18·1	974	22·3	300	6·9
Other Districts	...	9,468	17·2	9,263	16·9	2,563	4·7
<i>2nd quarter—</i>							
Large Burghs	...	13,200	19·7	8,221	12·3	5,172	7·7
includ- { Glasgow	...	5,735	20·7	3,416	12·4	2,201	7·9
ing { Edinburgh	...	1,815	16·1	1,335	11·8	936	8·3
Dundee	...	846	19·1	541	12·2	337	7·6
Other Districts	...	10,012	18·0	6,900	12·4	3,004	5·4
<i>3rd quarter—</i>							
Large Burghs	...	11,757	17·4	7,157	10·6	7,009	10·3
includ- { Glasgow	...	5,123	18·3	2,957	10·6	2,928	10·5
ing { Edinburgh	...	1,672	14·7	1,232	10·8	1,361	11·9
Dundee	...	748	16·7	497	11·1	433	9·7
Other Districts	...	9,379	16·7	5,937	10·6	3,243	5·8
<i>4th quarter—</i>							
Large Burghs	...	11,364	16·8	8,876	13·1	5,294	7·8
includ- { Glasgow	...	5,039	18·0	3,787	13·5	2,163	7·7
ing { Edinburgh	...	1,646	14·5	1,522	13·4	966	8·5
Dundee	...	712	15·9	565	12·6	322	7·2
Other Districts	...	9,051	16·1	7,007	12·5	3,429	6·1

No. III.—NORTHERN IRELAND.

NORTHERN IRELAND.—*Number of Births, Deaths and Marriages for each Quarter of 1933 and their Proportion to the Population.*

	Births.		Deaths.		Marriages.	
	Number.	Annual rate per 1,000 of population	Number.	Annual rate per 1,000 of population	Number.	Annual rate per 1,000 of population.
1st quarter ...	6,137	19·3	6,234	19·5	1,428	4·5
2nd „ ...	6,629	20·8	4,124	13·0	1,971	6·2
3rd „ ...	6,273	19·7	3,517	11·1	2,266	7·1
4th „ ...	5,620	17·7	4,294	13·5	1,979	6·2
Total for year 1933	24,659	19·4	18,169	14·3	7,644	6·0

Population of Northern Ireland, estimated provisionally to mid-1933 (inclusive of military):—1,272,000.

	Births.		Deaths.		Marriages.	
	Number.	Annual rate per 1,000 persons.	Number.	Annual rate per 1,000 persons.	Number.	Annual rate per 1,000 persons.
<i>1st quarter—</i>						
Total rural districts	2,615	16·9	2,875	18·6		
Total co. boroughs and urban dists.	3,522	22·0	3,328	20·8		
Belfast C.B. ...	2,223	21·5	*2,328	22·5		
Londonderry C.B.	308	27·4	201	17·9		
<i>2nd quarter</i>						
Total rural districts	2,909	19·2	2,106	13·6		
Total co. boroughs and urban dists.	3,660	22·9	2,018	12·6		
Belfast C.B. ...	2,367	22·9	*1,349	13·0		
Londonderry C.B.	276	24·5	135	12·0		
<i>3rd quarter—</i>						
Total rural districts	2,926	19·0	1,698	11·0		
Total co. boroughs and urban dists.	3,347	20·9	1,819	11·4		
Belfast C.B. ...	2,049	19·8	*1,164	11·2		
Londonderry C.B.	320	28·4	122	10·8		
<i>4th quarter—</i>						
Total rural districts	2,576	16·7	2,059	13·3		
Total co. boroughs and urban dists.	3,044	19·1	2,235	14·0		
Belfast C.B. ...	1,953	18·9	*1,477	14·3		
Londonderry C.B.	257	22·8	172	15·3		

* Including deaths of persons admitted from Belfast into institutions outside the co. borough, numbering 94, 72, 56, and 100 in the respective quarters.

No. IV.—IRISH FREE STATE.

Number of Births, Deaths and Marriages in the Irish Free State for each quarter of the year 1933 and their proportion to the population.

1933.	Births.		Deaths.		Marriages.	
	Number.	Annual rate per 1,000 of population.	Number.	Annual rate per 1,000 of population.	Number.	Annual rate per 1,000 of population.
1st quarter ...	13,739	18·4	12,922	17·3	3,611	4·8
2nd „ ...	14,994	20·0	9,731	13·0	3,449	4·6
3rd „ ...	14,923	20·0	8,267	11·1	3,533	4·8
4th „ ..	13,768	18·4	9,730	13·0	3,354	4·5
Total for year 1933	57,424	19·2	40,650	13·6	13,967	4·7

Population of the Free State estimated to mid-1933 :—2,992,000

1933.	Births.		Deaths.		Marriages.	
	Number.	Annual rate per 1,000 persons.	Number.	Annual rate per 1,000 persons.	Number.	Annual rate per 1,000 persons.
<i>1st quarter—</i>						
Total rural districts	8,534	16·3	8,602	16·4		
Total urban „	5,205	23·3	4,320	19·4		
Dublin City ...	2,642	25·2	2,179	20·8		
Cork Co. Borough	456	23·2	360	18·3		
<i>2nd quarter—</i>						
Total rural districts	9,564	18·2	6,669	12·7		
Total urban „	5,430	24·3	3,062	13·7		
Dublin City ...	2,801	26·7	1,395	13·3		
Cork Co. Borough	461	23·5	287	13·6		
<i>3rd quarter—</i>						
Total rural districts	9,304	17·7	5,587	10·6		
Total urban „	5,619	25·2	2,680	12·3		
Dublin City ...	2,854	27·2	1,240	11·8		
Cork Co. Borough	440	22·4	275	14·0		
<i>4th quarter—</i>						
Total rural districts	8,918	17·0	6,486	12·4		
Total urban „	4,850	21·7	3,244	14·5		
Dublin City ...	2,396	22·8	1,591	15·2		
Cork Co. Borough	370	18·9	266	13·6		

Note.—Dublin City rates based on 1933 population estimate; the others, on census population, 1926.

No. V.—GREAT BRITAIN AND IRELAND.

SUMMARY of BIRTHS, DEATHS and MARRIAGES, in the Year 1933.

(Compiled from the Quarterly Returns of the respective Registrars-General.)

Countries.	[00 's omitted.]		Births.	Per 1,000 of Popula- tion.	Deaths.	Per 1,000 of popula- tion.	Mar- riages.	Per 1,000 of popu- lation.
	Area in square miles	Popula- tion in 1933, estimated						
England and Wales ...	37,340	40,350	No.	Ratio	No.	Ratio	No.	Ratio.
Scotland ...	19,462	4,916	580,850	14.4	496,550	12.3	317,394	7.9
Northern Ire- land ...	3,488	1,272	86,546	17.6	64,848	13.2	34,215	7.0
			24,659	19.4	18,169	14.3	7,644	6.0
Great Britain and North- ern Ireland	60,290	46,536	692,055	14.9	579,567	12.5	359,253	7.7
Irish Free State ...	17,254	2,992	57,424	19.2	40,650	13.6	13,967	4.7

JOURNAL
OF THE ROYAL STATISTICAL SOCIETY
PART III, 1934.

INDIA'S TRADE AND INDUSTRIAL STATISTICS, PAST, PRESENT
AND FUTURE.

By SIR H. A. F. LINDSAY, K.C.I.E., C.B.E., I.C.S.

[Read before the Royal Statistical Society, March 20th, 1934, DR. J. BONAR,
Vice-President, in the Chair.]

WHEN I consented to read a paper on India's trade and industrial statistics, past, present and future, I was careful to give no guarantee that past, present and future would each receive one-third either of my space or of your time. Let me warn you, therefore, that the lion's share of this paper will go to the future. And that is only reasonable. The chief value of trade and industrial statistics is to the business man. Too often, alas, they only reach him through the medium of a Government office which isolates and expounds and thus saves him the trouble of surveying the whole picture and of thinking out his own sector for himself. But in any case I trust you will agree that merchant and industrialist are the chief beneficiaries; and both merchant and industrialist are alike in this, that their success depends largely on their ability to take a view of the future which must itself depend on a capacity to estimate correctly past facts and present tendencies. In other words, their work trains them to "look backwards into the future."

In parenthesis, I venture to suggest that a really adequate survey of the function of speculation in industry and trade still remains to be written. The field is very wide. There is, firstly, the merchant who anticipates a certain consumption and must sell at prices calculated to give a profit, yet without unduly encouraging competition. The industrialist must take even longer views. He may hedge on his raw materials. But even so he takes an initial risk in installing machinery, which changes of fashion may render com-

pletely out of date. In his normal business he is averse to fluctuations. For example, it is no uncommon practice among Calcutta jute mill-owners to find them selling jute goods only to shippers, in order that they may avoid flooding the local market. Finally, there is the pure speculator who merely gambles in futures and accentuates what might otherwise be mild and temporary trends. Although he may check a further fall by buying, and check a further rise when he clears out, nevertheless his influence is directed to pushing prices beyond their normal maximum when he is in possession, and when he eventually retires his departure helps to accentuate the resulting fall. Each character plays his part. There is not one whose success as a business man does not, in some degree, depend on his ability to estimate trends.

My parenthesis is relevant to this extent, that if statistics are to afford to the business man all the help he can legitimately expect, then they must take shape and quality on a careful estimate of business requirements. Otherwise the statistician will merely find himself following and correcting the business man instead of assuming his true role of preceding and advising or warning him. It is for this reason that future developments in trade and industrial statistics are of such importance, particularly in these days when trade depression reveals the valley of transition through which we are passing and throws into strong relief the uplands of future recovery. We must somehow arrive at such improvements of matter and of presentation as will enable the business man to draw more and more accurate conclusions as to the strength and direction of current tendencies.

In considering India's trade and industrial statistics you will please remember that our commercial development in India has been very different from yours in the United Kingdom, and, therefore, that our statistics have developed differently to meet needs different from yours. It is not so much that the Indian system or method of collection is different, as that the emphasis falls, with us, on different classes and groups of statistics. In this country, while almost all your agricultural production is locally consumed, it is perhaps no exaggeration to say that there is no single class of your industrial production of any importance which does not find its way into some corner of the world, however remote. With us the position is reversed. Our industrial production is sold chiefly in our own local markets, while our agricultural and mineral wealth is in varying degrees surplus to local needs and the surplus is sold abroad. But even here one must bear in mind that, so far at least as our agricultural production is concerned, this surplus is comparatively small. It is estimated that, of all the cultivated lands in India,

only one acre in eleven produces for export. In other words, while external trade is of great importance to the United Kingdom, India is chiefly preoccupied with her internal trade. In the result, we have devoted a great deal of care and attention to our agricultural statistics, including crop forecasts. Our mineral statistics are not quite so complete, yet they are reliable so far as concerns mineral production in areas of which Government is the landlord. Our import and export statistics are based on material carefully recorded in our Custom Houses; and we are making serious efforts to improve our industrial and internal (rail and river-borne) trade statistics, and have already attained some measure of success in this field, the important field of local industry and trade.

I do not propose to dwell for long on the past history of Indian statistics. In 1871 the post of Director-General of Statistics was created and the first incumbent was Sir William Hunter. During these early years the development of chief interest was the passing away of the old spirit of departmentalism in favour of new methods of expert control. From one point of view, of course, a Department of the Government of India collecting its own statistics and publishing them with its own comments could claim to be expert, in the sense that it had first-hand knowledge of the subjects which it administered and of the statistics illustrating those subjects and their administration. From another point of view the administrative Department was highly inexpert, for it possessed no statistical technique. In collecting, reviewing and publishing its own statistics it was a law unto itself; and the intelligent student of Indian economic affairs found it difficult to correlate the results. In 1895 an advance was made with the delegation to the Director-General of Statistics (then Mr. J. E. O'Connor) of responsibility for the reviewing and publishing of Indian statistics. But their collection was still a departmental matter. In other words, the Director-General was in those days responsible for the review but not for the materials which he was reviewing.

In 1905 came a further change, and a definite extension of the system of expert control. The Department of Statistics was then merged in a new Department of Commercial Intelligence, which owed its inception to Lord Curzon and of which Mr. Noel Paton was the first Director-General. In 1914 the Department of Statistics was separated from that of Commercial Intelligence, but this was only a temporary change, and in 1922 the two departments were reunited under the Director-General of Commercial Intelligence and Statistics, supported by a Deputy Director of Commercial Intelligence and a Deputy Director of Statistics. To these has been added, quite recently, a Deputy Director of Statistical Research.

The history of these developments may be summed up briefly as follows :—

- (a) A period when local authorities were responsible to the Departments of the Government of India concerned for the collection of statistics which each Department then passed in review.
- (b) A period when an expert statistician published (and reviewed) statistics received from local authorities via the central Departments.
- (c) The present situation in which the local authorities forward their statistics direct to the expert for compilation and review.

This progress from departmental control to specialist control is important. It means the disappearance of the water-tight compartment and the substitution of a system of unified control whereby the task of correlating statistics and reviewing national developments in different spheres of trade and industry is simplified. It has meant more. It has meant the development of Indian statistics on improved lines which have fitted them for international use. In other words, the general progress is from the local and departmental to the national and thence to the international sphere. And in this progression it is proper also to note the contributions which India has made at various Imperial Conferences to the task of co-ordinating commercial statistics on an all-Empire basis.

We arrive thus at the present-day system in India. Its organization has already been described. I have not tried to review the various classes of statistics as they evolved gradually in the past. But it is important to recognize that the field now covered is fairly extensive, and in order to give a clear idea of the work now being done I attach a summary of the principal kinds of trade and industrial statistics published under the authority of the Government of India. It will be noticed that agricultural statistics figure prominently. Each of nine staple crops of India receives separate treatment by way of forecasts of acreage and yield; three, four and sometimes five forecasts are issued for each of these crops province by province during the growing seasons and the final results of twenty crops are summarized for the year in a single publication. Three crops receive separate treatment in annual volumes with special reference to production, exports and prices. Statistics of local and all-Indian prices are published monthly and annually, and two series of index-numbers are prepared, one based on 1873 prices and one on the prices of July, 1914. Statistics of industrial output are a recent development and will be noticed in detail later. On the

trade side, imports, exports and re-exports of merchandise and treasure, shipping and customs returns are published monthly and (in greater detail) annually. Frontier and coasting trade statistics are published, and a special feature is made of internal trade. The whole of India is mapped out into eighteen blocks and monthly movements of thirty-two staple commodities are shown between these blocks. In addition, weekly arrivals and despatches of twenty-eight selected commodities are published to and from thirty-six important markets. On the financial side, special tables indicate annual changes in the numbers, capital, etc. of joint-stock companies, banks and co-operative societies. Finally, although no year-book of India is published as such, the information usually published in year-books is to be found in two annual volumes, the *Statistical Abstract for British India* and the *Review of the Trade of India*.

I now turn to the more speculative and perhaps more controversial aspects of my subject, namely, future developments of Indian statistics in the fields of trade and industry. We have already noticed a development which occurred at the close of last century from departmental to expert, technical control. This development is important not only in its bearing on present technique, but also in its implications for the future. The fact is that the ordinary business man (and the Indian business man is no exception) is growing more and more interested not merely in the improvement of his own national statistics, but also in those of other countries with which, as a producer for his own or foreign markets, he may happen to be in competition. The same is true of Government circles. It will be expected, then, that the statistical services required both by Governments and by business interests are likely to expand and particularly to invade the international field. The statistics published by the Economic Organization of the League of Nations are a case in point. It is not enough that national statistics should be adequate, accurate and promptly published. They must also be capable of meeting international requirements. The International Statistics Conference of 1928 was an attempt to secure greater uniformity in the domain of international statistics. India took part and threw her weight in favour of internationalism where this was possible. The difficulty is, of course, to secure uniformity of weights, measures and values. Fortunately it is possible to obtain these by calculation without waiting for an international currency or for some agreed international metre or ton.

We have arrived, then, at a position in which India is willing to contribute her statistics on some agreed and reciprocal basis for conversion to international standards for international consumption. This is already done on a world-wide scale, in respect of a few staple

commodities and services, by the Secretariat of the League of Nations and also, on a British Empire basis, in preparation for meetings of Imperial Conferences. But much yet remains to be done to collate the results, by commodities, and to make them readily accessible to the man in the street. When one looks back on pre-war days one is struck by the fact that many of the bumps and jars which then used to disturb the world's commerce were due to the fact that some individual, more lucky or more astute than the rest, had secured advance information readily convertible into cash. Nowadays it is extremely difficult for the would-be speculator, who is not pure gambler, to obtain any reliable information about any world commodity which is not equally and simultaneously accessible to all his competitors. In short, information of real value to the business community is nowadays a matter for Reuter and the daily press. The secret service business agent has almost completely disappeared. So our watchword for the future is greater and greater specialization accompanied by even wider publicity than present-day methods afford.

It is sometimes stated, and with some truth, that most of the countries of western Europe seem to have spent the last century or half-century in stimulating their manufacturing industries at the expense of their agriculture. They are now trying to save what they can from the wreck. Those are the countries of what might be called the medium-sized agricultural holding. The system of the future -- or at any rate the system with the greatest present promise--seems to be either the large-scale holding of America or Australia or the small-scale holding of Asia. India is a country of small holdings and a country which, while developing the manufactures for which her resources of men and materials best fit her, must place agriculture in the forefront of her national economy. Although the small holding renders very difficult the collection of agricultural statistics it is surprising what success has been attained in this sphere. The co-operation of revenue officer and agricultural expert has been singularly happy and the resulting crop forecasts have on the whole been adequate and punctual. Where they have erred in the past they have erred chiefly in under-estimation.

Under-estimation is a difficult fault to correct, for it is the result of an over-anxiety complex not at all peculiar to the Indian agriculturist. Let me give two concrete examples. For many years past the cotton and jute trades in India have kept their own records of the disposal of each season's crop as it appeared on the market. I cannot say exactly from what sources these statements are compiled—they include, of course, exports, mill consumption and extra-mill consumption—but I think it is fairly safe to conclude that there

has been little or no overlap between the various sources of information, and I think we are justified in concluding that the trade estimate which is based on past actuals must be fairly close to the mark.

The result of these seasonal surveys by the cotton and jute trades and of their comparison with the official forecasts is striking. Taking the last ten years for which statistics are available, the trade record of the actual cotton crop which came into sight each season exceeded the official estimate by 838,000 bales on a total average annual crop, for the ten years, of 5,380,000 bales. In the case of jute the trade estimate exceeded the official estimate by 119,000 bales each season on an annual average crop during the ten years of 8,633,000 bales.

In these circumstances, efforts are being made to improve Indian crop forecasts in two directions, the one retrospective and the other prospective. The former simply consists in an accumulation of all available data bearing on the distribution of the crop after it has been reaped. It was impossible to launch a single campaign of this kind for all Indian crops forecasted, and it was necessary, therefore, to concentrate on one crop at the start. The selected crop was cotton, the most important of the Indian cultivator's cash-crops. Returns of cotton-pressing activities and of the consumption of raw cotton by Indian mills are statutory obligations. Extra-factory consumption of cotton is roughly estimated for all India, and variations of stocks between one season and another are taken into the account so far as possible. Inter-provincial movements of cotton are also calculated. Such are the data collected to check the cotton forecasts by the retrospective or post-mortem method. The prospective method is simpler to describe. It consists chiefly in the gradual education of the data-collecting agencies, so that they may be trained to take into account, in the preparation of their respective shares of cotton forecasts during subsequent years, new materials which have only emerged as a result of the post-mortem method. The co-ordination of the various methods aimed at securing a greater accuracy in cotton crop forecasts has been entrusted to an expert body known as the Forecast Improvement Sub-Committee of the Indian Central Cotton Committee. The practical experience thus gained will doubtless be turned to account by application to crops other than cotton.

In a country as large and as populous as India, internal trade accounts for a very high proportion of the total annual turnover. Although railway freight charges per ton-mile are light, railway leads are long and consequently transport charges count for more in the internal economy of India than they do in a country where land-

leads are comparatively short. One result of this is that we find co-existing in India, even in the same areas, large-scale and small-scale industries utilizing the same raw materials, producing roughly the same classes of goods and supplying sometimes the same classes of consumers and sometimes different classes. The hand-loom and the cotton-mill may be cited as illustrations, the large and small oil-crushing concerns, sugar refined and unrefined, hosiery, fruit-canning, lampware, glassware, leatherware and so on. It appears that there is room for both. The large-scale factory has to draw its raw materials from a wide area, and can only find sufficient customers by pushing its products far afield. The same area of operations may cover quite a number of small-scale concerns, each buying a few raw materials in its immediate neighbourhood and selling its small output in the same neighbourhood.

Not only from the agricultural but also from the industrial point of view, therefore, statistics of inland transport in India are important. Discontinued ten years ago, as a measure of economy, these statistics have recently been revived in a new and improved form. By this means it will be possible to gauge fluctuations in the demands and supplies of staple commodities, raw and manufactured, in different areas in India, and consequently to gauge fluctuations also in the economic condition of the people. Statistics of factories, employment and wages have been recorded and published in India for many years past; but an innovation, and one which promises useful results for the future, is the publication of monthly statistics of the output of eleven industries of major importance to India—jute manufactures, paper, cement, matches, sugar, flour, iron and steel, kerosene, petrol, sulphuric acid and sulphate of ammonia. In addition, cotton-spinning and weaving statistics and coal statistics have been adequately collected and published for many years past.

From this account you will see that India is devoting considerable attention to her industrial statistics. Indeed if these statistics work out according to plan she will develop a technique and an output far ahead of many other countries of equal or greater pre-eminence in the industrial world. This is a striking result, which promises well for the future. The detached observer of world economics carries away the impression that nowadays local industries are of greater importance than overseas trade. This statement requires, I know, some qualification before it can be accepted. In the first place, the distinction between industry and trade is artificial, for industry merges in trade (whether internal or external) and it is impossible to draw a hard-and-fast line between the two. Secondly, in what sense can industry be more "important" than trade? Yet

I believe there is something in the contention that local industries are at present occupying more of the attention of Governments than ever before, at the expense of international trade. Government revenues are, of course, a factor. Import duties have in most countries been forced far above the point of diminishing returns in order that local employment may be stimulated and the cost of local relief measures reduced. In the race to avoid national bankruptcy in highly industrial countries, the United Kingdom and the United States appear to be singularly fortunate, the former in having still retained import duties as a source of revenue—subject, of course, to the free import of Empire products, most of which are raw materials—and the latter in having liquor excise as a reserve source of revenue. However that may be, world economics appear nowadays to be so pitched that industrial development is thrown into strong relief as a factor contributing to national prosperity. “Planning” is the order of the day and Indian experiments with industrial and inland trade statistics will undoubtedly help to supply some of the data necessary towards the perfection of the science of distribution of which we all hear so much and realize so little.

Of future developments in India's overseas trade statistics I have very little to say. But there is one gap in them to which I venture to draw attention. It is a gap which, I fear, would cost a good deal in clerical staff, time and trouble to fill. It is a gap which I mention without fear or favour, and without reserve, for so far as I am aware no country has ever yet been able to fill it. It is briefly this. While all published systems of foreign trade statistics are content to show the quantities and values of trade with other countries or groups of countries, no attempt has ever yet been made so far as I am aware to compare these various lines of trade on a qualitative basis. For example, the trade of the United Kingdom with France is so much and with Germany so much—let us assume pounds sterling to be the unit. Is it not quite unsafe to suppose that the higher number of pounds involved in either the one trade or the other is a measure of greater national profit? And yet do we not continually argue on this very unsound hypothesis? Would it not be possible to apply some simple “weighting” formula whereby imported manufactures and raw materials imported and re-exported without processing are given a fairly low unit of value in an attempt to assess the quality of international trade? Whereas raw materials produced for export or imported for processing, manufactured goods made for export from imported raw materials or semi-manufactures, and finally manufactures made for export from local raw materials are each given their due value? I venture to suggest that if the United Kingdom Government were to adopt

some such system there would be far fewer misapprehensions than exist at present, in the comparative value to this country of trade with Empire and foreign countries respectively.

I now turn to the question of price statistics, a question peculiarly difficult in a country so large as India, and one with so many markets specializing in so many different commodities. So far as retail prices are concerned the solution is fairly simple. A cost of living index figure can be, and is, worked out on the basis of family budgets for each of thirteen different markets. But a single cost of living figure cannot be calculated for the whole of India with any hope of giving an accurate picture. We must therefore content ourselves with the thirteen indices.

So far as wholesale prices are concerned, the objective is twofold. We wish to answer two quite separate questions :—

- (a) How have prices fluctuated for any given commodity or grade or group of commodities throughout the whole of India and during what periods?
- (b) What has been the average of the fluctuations, in any particular area, of the wholesale prices of the staple commodities in which the inhabitants of that area are specially interested and during what periods?

To these two may be added, for later consideration at the end of this paper :—

- (c) With what reasonable chances of success can we construct an index-number of wholesale prices for India as a whole?

Firstly, then, the wholesale price of any given commodity for the whole of India. The range of grades (and consequently of prices) is so wide, and weather conditions during any particular season may vary so much in different areas, that an average for all India of all prices obtained in all important markets for, say, rice or cotton or wheat, is not of quite the same value as that which a similar calculation would give, say, for a European country of moderate size in which sowing and harvesting conditions are more or less uniform throughout the area considered. The average of customs declarations for export is unsatisfactory, for it limits the calculation to prices at the ports, whereas internal prices are more truly representative, if a reasonable average of such prices could be obtained. We are therefore forced to fall back on the statistics of the price of a single grade, or else on the average prices of a group of commodities sufficiently closely related to each other to present an effective picture (*e.g.* “cereals” or “pulses” or “oil-seeds”). In

actual practice both sets of prices are compiled and published in India.

Secondly, we require a series to illustrate fluctuations in the prices of staple commodities in a given market or area. For many years past such prices have been collected and published for various commodities and various markets of India and particularly for Calcutta. Since January, 1931, a new series has been introduced which shows monthly fluctuations in the prices of selected staple commodities in each of eight selected markets—Calcutta, Bombay, Karachi, Lahore, Bangalore, Madras, Patna, and Rangoon. These markets are typical of northern, central and southern India and of Burma. The prices collected will provide the raw material for economic studies of price-ranges embracing staple commodities over the whole of India. It has yet to be decided on what exact pattern the statistics now regularly collected and published will be used for the purpose of an all-India price index-number.

At this juncture I wish to recall a point made earlier in this paper—and one which I hope will have commended itself to you—namely, that both Government and business circles in any particular country are taking an increasing interest in economic conditions in other countries. This interest may merely denote a desire to exclude unwelcome imports or an ambition to invade a foreign market which has left some approach unguarded. In any case comparisons between economic conditions at home and abroad are becoming increasingly popular. Psychologically it is of immense importance to a parent whose child is ill to ascertain whether the illness is due to a survival of the old Adam, shown, for example, in over-eating and cured by disciplinary measures, or whether it is the result of an infection which must not be allowed to spread through the family, if precautionary measures are at all possible. To facilitate such analyses and comparisons, the World Conference of 1927 recommended that each participating State should organize a barometer whereby fluctuations in local economic conditions could be studied in conjunction with the readings of neighbouring barometers. In other words, index-numbers of the principal economic activities in the various States would reveal whether a particular depression was world-wide or localized, and whether in the latter event it could be overcome before it was allowed to become an infectious case. Alas, in the event, the localization of a depression has too often stimulated violent measures of self-defence which have merely hurt other States without curing the central disease. It is as if the policy of economic isolation undertaken in the first instance as a remedy were itself becoming the infection.

However that may be, it is admitted on all sides that the study

of economic conditions cannot be localized but must be spread as widely as possible, and that such studies are best facilitated by readings of local barometric pressures as demonstrated by national index-numbers. An intelligent system of index-numbers intelligently handled will contribute reliable data for the State which has evolved it and will facilitate a comparison of results with those of other States equally well served.

India at present relies on two series of index-numbers: one which calculates the present prices of certain Indian products in percentages of the price-levels of those products ruling in 1873. Unfortunately the basic year is too remote, and the sixty years which have passed have distorted the representative character of the staple products then selected. Moreover, the methods of calculation originally adopted—which cannot now be altered without spoiling the sequence—are now seriously out of date. The second series applies only to staple products of the Calcutta market, and is based on the prices ruling in July, 1914. This is the series now in common use for India, but its limitations are obvious. The basic period is too narrow and the range of commodities, though perhaps as wide as any to be found in any other single market of India, is not sufficiently representative of Indian trade as a whole. In these circumstances it has been decided to collect and publish monthly price statistics of staple commodities typical of the eight markets already mentioned as representative of northern, central and southern India and of Burma. These statistics will form the basis of a new all-India index-number according to a system which still remains to be formulated.

To sum up, if, as our American friends tell us, "planning" is to be the order of the day and if we are passing from a regime of *laissez-faire* to a regime of conscious, even self-conscious, economics, then all the more imperative becomes the need for adequate, accurate and up-to-date statistics renewed at sufficiently short intervals to present fluctuations faithfully and punctually. There is room also for expert commentary to accompany expert presentation. And, finally, *ad hoc* statistical research in India, which was formerly entrusted to the regular staff as and when personnel could be spared from routine duties, is now a recognized function of the Director-General of Commercial Intelligence and Statistics, who is assisted in this branch of his work by a newly-created Deputy Director of Statistical Research. This innovation, with other improvements recently effected in India, will always be associated with the name of Dr. D. B. Meek, C.I.E., the present Director-General.

If India is experimenting in the direction of improved agricultural statistics and an improved price index-number, and in the collection

of industrial and inland trade statistics, there is good ground for hoping that the results will not only benefit her nationally but will also be appreciated in international fields.

APPENDIX

TRADE AND INDUSTRIAL STATISTICS OF THE GOVERNMENT OF INDIA.

AGRICULTURAL.

Seasonal Crop Forecasts :—Rice, Linseed, Sesamum, Sugar-cane, Wheat, Rape, Groundnut, Cotton, Mustard, Castor.

Annual Estimates of the Area and Yield of the Principal Crops.

Annual Agricultural Statistics.

Annual Reviews and Statistics :—Sugar, Tobacco, Tea, Cotton (monthly, internal trade), Coffee, Rubber, Live-stock (quinquennial).

MINERALS.

Annual Statistics of Coal.

Annual Review of Department of Mines.

Annual Review of Geological Survey of India.

Quinquennial Review of the Mineral Production of India.

INDUSTRIAL.

Monthly Statistics of Cotton-pressing, spinning and weaving.

Monthly Statistics of Output of other selected Industries.

Annual Statistics of Factories subjected to the Indian Factories Act.

Large Industrial Establishments in India (biennial).

TRADE.

Monthly and Annual Sea-borne Trade and Navigation Accounts.

Monthly and Annual Land Frontier Trade Accounts.

Monthly and Annual Coasting Trade and Navigation Accounts.

Annual Review of the Trade of India.

PRICES.

Quarterly Statistics of Wholesale Prices.

Annual Series of Index-numbers based on 1873.

Monthly and Annual Series of Index-numbers, Calcutta.

GENERAL.

Statistical Abstract for British India.

DISCUSSION ON SIR HARRY LINDSAY'S PAPER

THE CHAIRMAN said they had listened with great interest to this paper, the subject of which was one of the most important before the British people at present. There was only a limited number of people who had authority to speak on a paper of this kind, and he proposed to call upon one of that number to propose the Vote of Thanks. He had pleasure in asking Mr. Stanley Jevons to address the meeting.

MR. STANLEY JEVONS : I have much pleasure in proposing a vote of thanks to Sir Harry Lindsay. Many of us here, I have no doubt, are familiar with the reports which he, as Trade Commissioner, has issued, and we know how thoroughly he has studied his subject. You will remember that those reports were issued formerly every few years, and were voluminous. Latterly he has issued quarterly reports and an annual report to supplement them. The quarterly reports appear in the *Indian Trade Journal*, which, by the way, is a very useful source of what I may call partly digested statistics. A number of statistics extracted from the Indian publications are to be found there; and are thus easily available in this country. I might mention also, for those persons who are interested in studying Indian statistics at all thoroughly, that the publications containing them are always to be found either in the Library of the India Office or in the Library of the Office of the High Commissioner for India, which is conveniently situated in Aldwych. There is no excuse for anybody in London saying that he does not find it possible to get statistics about India.

Sir Harry Lindsay's main business is to aid the selling of Indian goods in this country and in some other parts of the world. Possibly that has led him to be interested in statistics mainly from the point of view not of the economist or theoretical student of social affairs but of the business man; and so a good deal of this paper bears upon the manner in which the business man might make a greater use of statistics than he does. I cannot feel, however, that an appeal to the English business man to make a thorough use of statistics is likely to be very fruitful. There are countries in which the business men pay a great deal more attention to statistics than we do here. I hope, however, that this paper will influence a few of them to study the statistics of India, because, as Sir Harry Lindsay has pointed out, these statistics are becoming far more complete, having in recent years been so much improved that I venture to say they will stand comparison with the statistics of almost any country in the world.

There is one point, however, that I should have liked to have seen brought out in the paper; namely, that if the business man can be persuaded to make use of statistics, it would be a good thing if he would take in a somewhat wider range than Sir Harry Lindsay has indicated. I mean that the man who is really going to develop a trade with India from this country, or any other, ought not merely to look at the statistics of Indian trade as they have been, but should

understand something of the social conditions and of the agriculture and industries. It is important to understand, for instance, what developments have been taking place in such matters as irrigation. Immense irrigation schemes have been projected and completed in recent years in India. Indian irrigation schemes are the largest in the world and little is known about these schemes in this country. Enormous areas in the Punjab and Rajputana, and latterly in Sindh, have been brought under cultivation through these irrigation schemes; and a population is settling and growing up on these areas, so that they cannot fail to be the big markets of the future in the North of India.

But it would be interesting also for the business man to know more about Banking in India. The annual reports on Banking Statistics do not seem to be mentioned in the Appendix. Unfortunately this report is issued very late and the figures are often more than a year old; but they do give a good deal of valuable information about Indian banks.

Then again, with regard to the question of the cost of living, there have been extensive enquiries on the cost of living budgets, starting with those of Mr. Findlay Shirras in Bombay, followed by enquiries in a number of towns, including one recently carried out in Rangoon by Mr. Bennison of the Indian Civil Service. Whether all of these are of a high accuracy one cannot say; but in any case the error is not likely to be such as to make them useless to English people who want to get a general idea of the standard of living of the industrial classes of India. Such enquiries have also been carried out in regard to agriculturists and even for middle-class families. I want to suggest that there is a branch of statistics touching all sides of social life in India, just as in other countries, and that it should not be overlooked.

As regards agriculture, I suppose the opportunities of studying the land tenure system, and so on, in special reports, such, for example, as the irrigation administration reports, are perhaps more detailed than those available for any other country. In fact, masses of information are to be found both in annual reports and special enquiries, like the Economic Enquiry Committee, of which my friend Mr. Burnett-Hurst was a member and Secretary, and accompanying the reports of Royal Commissions such as the recent Commission on Indian Labour, or the great Banking Enquiry whose ten-volume report was completed two years ago. The mass of information in these reports, including statistics not appearing in other reports, provides a wide field of study for anyone who will undertake it.

I was particularly interested in the history which Sir Harry Lindsay gave of the development of the Central Statistical Department in India, and the further development which he mentions as now to take place of appointing a Deputy Director in charge of research. It is highly desirable in my opinion that some steps should be taken by a Statistical Office of that kind to assess the value of the statistics which they publish and to give the public as much information as they can on the subject. I know that this is a very controversial question, but I would put it this way. It always seems to me that when

statistics are published about which the officers in charge of the Department which issues them have some doubt, it is not quite honest to leave the public to draw inferences from them which may not be fully justified. The Government of India was candid enough to admit two or three years ago that statistics of prices and wages which it had been publishing since some time in the nineteenth century were so inaccurate that it was not worth while continuing the series. I was very glad that they did candidly admit that; and it was of help to all students to know that the figures could not be relied on. There is one useful point in the Indian system of official statistics, namely, that we do get a certain amount of explanation—or, shall I say, interpretation—of trade statistics, which at any rate is a great help to the person who has not much time to study them. I refer to the Annual Review of Foreign Trade. This, like the first volume of the Census Reports, is descriptive. The personal equation of the officer is kept down as much as possible; and it is of great assistance to any students of Indian foreign trade to have such comparisons of the figures made for them with occasional comments. The Census volumes should always be in the minds of people who are going to study India from any point of view.

I will not take up more time, but I should like to add to my proposal for a hearty vote of thanks that I am personally very grateful to Sir Harry Lindsay for his interesting paper.

MR. A. R. BURNETT-HURST: I have very great pleasure in seconding this vote of thanks. I think the Council asked me to do so because I happen to have held the first Chair of Statistics in India; but I welcome the opportunity for another reason. I think I have probably known Sir Harry for a greater length of time than any Fellow of the Society. I first met him at school, when he secured his University Scholarship, and I remember joining in the applause we gave him. I now applaud him once more, and it gives me very great pleasure because of that particular memory and our close association in India, but especially because we are all agreed that this is a very valuable survey of an important matter, a survey in which Sir Harry has purposely excluded statistics in order to make it interesting to the layman.

Sir Harry has alluded to the reorganization of statistical work in India in recent years, and he has quite rightly paid tribute to Dr. Meek, but he does not mention the amount of spade-work and energy that various individuals and bodies have expended in urging the Government to bring about some change in Government statistics.

Mr. Jevons has referred to the reports of various boards dealing with statistics in a variety of forms. The Industrial Commission dealt with the improvement of official statistics; the Whitley Report of the Labour Commission dealt with labour and social conditions; and the Report of the Indian Economic Enquiry particularly has, I believe, been largely responsible for this change in the outlook of Indian statistics. I say that because there was an unfortunate difference of opinion with regard to that report, though on the major issues we were all agreed and we see that that

agreement has borne fruit although the main report has been pigeon-holed.

Sir Harry has given, if I may say so without being unduly critical, a somewhat rosy picture of Indian statistics. Organization and data are improving, but much remains to be done. The average audience in England cannot realize the difficulties of collecting statistics in India. I will take one subject, the question of retail prices. It is extremely difficult to collect retail prices in India, and revenue officers, collectors and Commissioners have frequently taken a short cut in order to get this piece of work over. They frequently send their servants out to collect the information from the bazaar and they furnish such information as may easily be procured. There is the danger that we may take facts collected in this way and published in official returns as accurate. One must bear in mind that frequently in India there is an ill-qualified agency for collecting the primary data, and if great care is not taken, inaccurate conclusions will be drawn from those data. If we bear in mind that the data collected are liable to a margin of error greater than in this country, then it can be accepted freely. I do not feel that I can share Mr. Jevons's view that the statistics of India at the present stage can stand comparison with those of almost any country in the world. I have made this subject my special study, and I have come to an entirely different conclusion.

Sir Harry has referred to the index-numbers that are based upon a collection of family budgets, but here again one must remember that the collection of family budgets in India is a more difficult task than it is in this country because of the structure of Indian society. Apart from the fact of the great differences between one part of the country and another, even within a city or town, there are great variations in the content of the population; different creeds, different castes, and different grades of Society. All these factors introduce much greater difficulties and complexities than would be experienced in this country, and unless the budgets are collected on a very large scale and in proportion to the relative numbers of different castes and creeds, there will be discrepancies.

Further, Sir Harry refers to the recent collection of statistics of large-scale industries. That has been the result of the recommendations of the Indian Economic Enquiry, but we suggested that not only the quantity, but also the value of the output should be ascertained, and we went a step further than that—that there should be a Census of Production. I hope Dr. Meek is bearing that in mind, and will eventually work up to a Quinquennial Census of Production.

Sir Harry has not made any reference to wage statistics. I sincerely hope that greater attention will be paid to wage statistics and also to the possibilities of instituting a Census of Wages.

Finally, Sir Harry seems to be satisfied with the present organization for the collection of statistics in India, but thinks that the present system of a Director of Commercial Intelligence with two Sub-Collectors and a complementary Wing, dealing with statistical research, is sufficient. I would go further; I should like to see in the course of time a Central Bureau of Statistics for India responsible

not only for the organization of the Census of Population but also for Quinquennial Censuses of Production and of Wages.

I have great pleasure in seconding this vote of thanks, and hope that members of the Society will associate themselves most heartily with this motion.

CAPTAIN I. F. L. ELLIOT said he spoke as a visitor, and when his friend, Sir William Larke of the National Federation of Iron and Steel Manufacturers—the industry in which he happened to be engaged—told him that Sir Harry Lindsay was reading this paper, and asked him if he could find time to come down, he confessed that he did not know at all what the Royal Statistical Society was, or whether he would be meeting a body of ordinary human beings, or—if he might be allowed to say so—a number of people who had all conceivable statistics locked up in their brains, and who only had to turn on the tap for them to come out. He was rather afraid the latter might be the case by the care that had been taken by the author of the paper to avoid giving any statistics.

He was particularly interested in the paper, as he had just returned from a visit to India on behalf of the industry in which he was engaged, in connection with a Tariff Board review of protective duties, and at every turn in the work which he was attempting to do in India on behalf of British industry, he found himself absolutely dependent upon such statistics as were available. He certainly came to the conclusion that the industrial statistics which were available—industrial figures of production in both major and secondary industries, import figures, and a good many other figures relative to his work—were extraordinarily reliable and well set out. He shuddered to think what might happen if these statistics on which he had based arguments in a great many directions were not reasonably accurate.

In addition to that part of his work in India, he had also been considering the question of developing the manufacture in India of various special products, and it would easily be understood how vital to decisions of that kind were the statistics of the trade of the country as a whole—largely internal figures.

This was not the place to bring in political questions, but Captain Elliot had noticed that in the earlier part of his paper Sir Harry Lindsay had referred to the great changes which were taking place in world economics, and he must confess that he had been tremendously impressed with the enormous possibilities of industrial development in India. It was possible to see signs of this in all sorts of small ways, and when one reflected that this particular portion of the British Empire contained a population which so many times exceeded the total population of the rest of the Empire, and considered the purely mathematical problem of what it might mean if the whole of that population could spend, say, one anna a week more, it gave one food for thought and, to the business men of the country, very serious food for thought as to the one direction in which they might certainly engage a greater part of their activities and look to the future for very great developments.

Captain Elliot had been most interested in the paper to which they had listened that evening, and would like to pay his tribute to the statistics which he had found available in India, which had been absolutely invaluable to him.

SIR CECIL KISCH said that it had been his great privilege as a visitor to the Society to hear this interesting paper on Indian statistics, with which, during a prolonged period, he had become familiar. It had also been gratifying to him to hear Mr. Jevons and Mr. Burnett-Hurst's endorsement of what Sir Harry Lindsay had said with reference to the general improvement of statistics, although Mr. Burnett-Hurst did not go so far as Mr. Jevons in his commendation. One thing that emerged was that the Government of India did realize that although statistics were once considered a luxury and a Department to be closed down in times of stress, they were now regarded as a necessity, and it was realized that statistics were essential to a correct understanding of economic conditions. This was the result of the work of a certain number of men who, those who knew India well would agree, were little short of geniuses, and who applied their gifts to adapting statistical apparatus to the unique conditions of India. Starting with Sir William Hunter, and coming down to the present time, an amazing piece of work had been done considering the size of the country, the physical difficulties and the problem of finding a really skilled agency for doing the work. The Government of India, realizing the importance of statistics, were now going ahead. It had not been mentioned that two distinguished Englishmen, Professor Bowley and Mr. Dennis Robertson, were now in India surveying the field of statistics and laying out plans for the future development of useful work in the statistical field of India. When they returned, more would be known about the possibilities of having in India a Census of Production and an Economic Survey of a more extensive type than had hitherto been deemed possible. The Government of India realized that the State must develop its statistics from the point of view of its own business. The State was the largest employer because it was the owner of nearly all the railways of India. Statistical services had perhaps not been developed sufficiently in the commercial field. In its economic and social administration the State would make many mistakes without correct statistics.

From the point of view of the business man, it was to be hoped that the statistics were accurate. In India they had an excellent scheme of statistics, but how far the working out of that scheme was accurate in view of the difficulties it was impossible at present to say.

At the present moment it was felt that statistics were to some extent under suspicion because it was sometimes said that they might prove anything. The proverb "You must catch your hare before you cook him" could be adapted to statistics; catch your statistics and then cook them. The reason for distrust was not that there was no faith in statistics, but that very often one did not get the right ones; given the right statistics, the correct interpretation would follow.

Sir Cecil said he would prefer on the whole to see greater attention devoted to improving the accuracy of existing statistics rather

than to the development of new lines. If he could believe that existing statistics were really accurate, he might feel much happier than if he had a greater quantity of statistics.

Sir Harry had spoken about the quality values of international trade. That was an interesting suggestion, but it should be looked at from the point of view of both sides. He had said that imported manufactures would have a low value, but those were exported manufactures from the point of view of the country which sent them, and if given a minus mark from the British point of view, they would have to be plussed from the point of view of France or the United States.

Sir Cecil welcomed the increased attention being given to international statistics; this was a subject the importance of which would grow. When the Reserve Bank was started, its policy would be largely influenced by its reading of the economic factors of India from time to time, and for that purpose they would desire to have accurate statistics in order to keep tendencies in India more or less in tune with what was going on outside. The Bank of England produced a monthly statement of the leading economic indices, and it was to be hoped that the Reserve Bank of India would eventually do the same for India.

Another point was the training of people to collect statistics and to interpret them in India. That was very important, and if more could be done in the way of training Indians to take up this work, it would be an extremely valuable thing.

Sir Harry Lindsay has said in his paper that the agriculturist was a born pessimist. Perhaps, however, part of the explanation lay in the fact that statisticians also are inclined to pessimism, preferring to under-estimate rather than to over-estimate. If the Indian statisticians under-estimated, let us say, the anticipated cotton crop and, after all, more cotton was produced, the agricultural community would, in general, not feel disappointed and the country's wealth would come out as greater than had been anticipated. Over-estimation in these matters would normally lead to disappointment if the results proved less favourable than had been forecasted.

The paper to which they had listened that afternoon would contribute largely to calling attention to these things, and Sir Cecil again expressed his pleasure at having been present, and hoped the paper would have a wide circulation, especially in India.

DR. H. SINHA said he wished to add his tribute to the writer of the paper that evening, because it fairly covered the field which had been chosen by its author; it did not pretend to cover financial statistics nor those issued by provincial Governments and non-official organizations. The few criticisms he had to offer were by way of footnotes and amplifications rather than correction of errors.

On p. 400 it was stated that Calcutta jute mill-owners sold jute goods only to shippers, thus preventing the flooding of the local market. In the course of his work in a Calcutta bank, Dr. Sinha came to know that every bank, including his, was called upon to make advances against hessian delivery orders, which passed from one hand to another before the goods were actually shipped; as a matter of fact,

every bank was called upon to see that rent and insurance charges for storage were not in arrears, and that the goods had not deteriorated in quality because of long storage. He agreed with Sir Harry Lindsay in his view that the business man of the future must be able to estimate, even though he might not be a gambler at all. Only Dr. Sinha would speak of mild and temporary *fluctuations* rather than of *trends* in that connection.

Or . 402 and on pp. 404, 405 a few changes were necessary in the description of Indian agricultural statistics, which had been discussed in detail in the current issue of the *Journal*. As regards the index-numbers of prices, two new series were available since September, 1929; one was for exports and the other for imports, both based on the prices of July, 1914. Dr. Sinha desired to draw attention to them, because they were very important; these two indices for exports and imports indicated in a rough way the term of international trade, and they were of value because they revealed the effect of the tariff, which was a sort of infectious disease rather than a remedy.

Internal trade statistics were available for different categories of cotton piece-goods and for various sub-groups within the twenty-eight groups of commodities mentioned; the only difficulty was that sufficient data had not been accumulated to permit any correction for seasonal fluctuations or a proper analysis for estimating purposes.

On p. 403 reference was made to international statistics. The main difficulty was stated to be the lack of uniformity in weights and measures used by various nations. These difficulties could be got over, but the main problem was the lack of agreed and accurate definitions in order that the same term might signify the same thing in all countries and at all times.

On p. 407 a new method had been suggested for foreign trade statistics with a view to bringing out their importance. In so far as the United Kingdom was concerned, the net output figures of the Censuses of Production offered valuable guides in this direction. India had nothing like that, and she must suffer by comparison in this respect.

The Appendix did not give a comprehensive picture of the field of Indian statistics chosen in the paper. The *Indian Trade Journal* should have been mentioned. The Quinquennial Reports of the Average Yields of Crops, etc., the Forest Administration Report and the Report on the Censuses of Live Stock, Ploughs and Carts in India, should also have been inserted. The Report of the Chief Inspector of Mines should have been included under its proper name in order to give a better idea of its scope, which was far wider than merely output figures. The last item in the list, and the most important, was the Statistical Abstract for British India. In the tenth and current issue of this Abstract, published in July last, the population figures were those of the 1921 Census, although the Census figures for 1931 were available in 1932. Might it not be possible to give more up-to-date figures in these official returns?

In conclusion, Dr. Sinha said he would like to mention that Dr. Meek, to whom praise had been very justly given, was not only the Director-General of Statistics and Commercial Intelligence of the

Government of India, but also Vice-President of the Indian Statistical Institute. In future, the official Department of Statistics, in India as elsewhere, would be called upon to give far more detailed statistics, collected, if necessary, on a compulsory basis, and to supervise their collection better in order that they might be of real value. For instance, in India at present there were no statistics of incomes of people who neither earned wages nor paid income tax—a heterogeneous body including some Bengal landlords. There were no statistics worth the name for pastoral and cottage industries. Even when these deficiencies were made good, there would still remain a keen demand for unofficial bodies to interpret and analyse the statistical data collected through official agencies.

Dr. Sinha said he had but remote connection with some of the work then being done by the Indian Statistical Institute in Calcutta and in the three branches at Bombay, Poona and Mysore. He could, therefore, speak without undue reserve about its value and importance. Some of the results of the researches would be available in the next few issues of the *Indian Journal of Statistics*. But some would take months or years of patient study before they would see the light of day, e.g. the problem of representing the Indian trade cycle not as a time series but in terms of certain economic parameters such as population and rainfall. On behalf of the Indian Statistical Institute, he would appeal to the Royal Statistical Society for help and co-operation in its difficult task.

Dr. HERON associated himself with the laudatory remarks made about the paper. He only regretted that it had not been twice its present length, because the additional matter would have been just as valuable and interesting.

Professor Jevons had referred to the fact that the *Banking Year Book* had not been included in the list of official publications, and he would like to refer to the *Insurance Year Book*, the omission of which was no doubt due to the fact it was prepared by the Government Actuary, an independent authority. This *Insurance Year Book* gave only the most meagre details about marine, fire and accident insurance, all of which were of considerable importance in India; it only gave full particulars about life business. It would be of great help to many of those interested in insurance in India if summaries of all classes of insurance could appear annually, as in this country.

Dr. SNOW said he would like to refer briefly to the paragraph in which Sir Harry Lindsay referred to future statistical developments in India. Sir Harry suggested that in future some alteration might be made in the form of Indian trade statistics so as to show in the export figures relating to manufactured goods the values of the exports which were attributable to Indian labour and capital. Using the terminology of the Census of Production report, he wanted the "net output" contained in the exports as distinct from the gross value.

Some time ago a paper had been contributed to the Society which dealt with this aspect of the exports from the United Kingdom, and it might be of interest to give a few figures which would serve to show

the importance of the point raised by Sir Harry. The paper in question dealt with the importance of the export trade of this country and pointed out such facts as the following :—In the figures of the exports of boots from the United Kingdom, out of £1,000,000 gross value only 72 per cent. is really due to the output of the country, the remaining 28 per cent. being due to imported raw materials. British exports were made up of many classes of goods, some depending greatly upon imported raw materials, such as cotton; others, such as coal, to a very small extent. It was important when comparing the true value of British exports with those of any other country, particularly India, that this should be taken into account.

SIR HARRY LINDSAY, in reply, said: So many points have been made that I find it very difficult to answer them all intelligently as well as comprehensively; but there are one or two points I should like to refer to now, and I shall begin with the last speaker, because he has put me in the position of saying that if India would only give the lead, the United Kingdom would follow. I had made the point that if the United Kingdom would start the principle of a valuation of the qualities of imports and exports, that would give us a lead, in which case I am sure the Dominions and India would gladly follow. Your experience in such cases must be much greater than ours. But I do think that suggestion is a valuable one from the point of view especially of the British Empire and the comparison of the real quality of the trade as between the Empire countries and as between Empire countries and foreign countries.

Dr. Sinha has said that India would come out rather badly in comparisons of that sort. It might be so at present, but from the point of view of the rapidity of the industrial development of India I do not think she would figure so badly in another few years.

Captain Elliot referred to his visit to India and to the help which the Indian Tariff Board gave him. I must say that I think the tribute which he gave to the Board was very well placed, because that Board has given a lead to other Empire countries in its extraordinarily penetrating analyses of the conditions under which Indian industries require and should get protection. It is a Board which analyses intelligently and honestly which are the industries for which the consumer in India should pay and to what extent. I think there are other parts of the Empire which might learn practical lessons from that.

The question of Banks, I must admit, was not discussed in this paper, because I wanted to confine it entirely to trade and industrial statistics, and although of course labour and wages questions really ought to have been brought in, I have only mentioned family budgets in a passing reference. I quite admit it is difficult to define what one means by trade and industrial statistics, but I chose them in rather a narrow sense. It has been suggested that forest statistics might be brought in, but the forest statistics only refer to Government Forests, and therefore they would be incomplete in any really comprehensive account of the timber production of India.

May I thank the Society once more for the very kind reception given to my paper?

As a result of the ballot taken during the meeting, the following candidates were elected Fellows of the Society :—

Luis Barreiro.

Stephen Wilfred Eveson, M.R.C.S., L.R.C.P., D.P.H.

Langton Haldane-Robertson.

Professor Friedrich A. Hayek.

Professor Arnold Plant.

Mohamed Hassan Salman, M.D.

Dorrell Kaye Rollit.

Corporate representative.

T. Eden, M.Sc., A.I.C. *representing the Tea Research Institute of Ceylon.*

METHODS USED IN DIFFERENT COUNTRIES FOR ESTIMATING NATIONAL INCOME.

By SIR JOSIAH STAMP, G.B.E., LL.D., D.Sc., F.B.A.

[Read at the Centenary Meeting of the Royal Statistical Society, held at University College, London, April 17, 1934, the PRESIDENT, the RT. HON. LORD MESTON OF AGRA AND DUNOTTAR, K.C.S.I., LL.D., in the Chair.]

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| 1. Scope of the present discussion. | 13. Intercensal Years and Interpolation generally. |
| 2. Definitions of National Income. | 14. Inventory Estimates and Agriculture. |
| 3. The Rival Concepts tested dynamically. | 15. Supplementary Services. |
| 4. The two Main Approaches. | 16. The Duplication Problems. |
| 5. The Income Method. | 17. Causes of Differences between the Methods. |
| 6. The Census Method. | 18. Territorial Divisions and Adjustments. |
| 7. The Impersonal Income Tax Statistics. | 19. The Element of Capital Value. |
| 8. Personal or Global Income Tax Statistics. | 20. Reconciliations. |
| 9. Individuals below the Levels charged to Income Tax. | 21. The Price Change Element. |
| 10. Wages. | 22. Conclusion. |
| 11. Intermediate Incomes. | 23. Authors consulted. [Note: The numbered references in the text are to this list.] |
| 12. The Census Proper. | |

1. *Scope of the Present Discussion.*

It is no part of my purpose in this paper to criticize or even summarize the various estimates that have been made of different national incomes in different years, a process which must involve an attempt to put them on to similar lines with identical scope, for this again involves special difficulties in times of rapidly changing price levels and exchange rates, if any comparable basis expressed in a single unit is to be obtained. An analysis of this kind was attempted by me some years ago, with a classification of the relative degrees of approximation to accuracy which the several estimates seemed to have * (71-2). It is rather my intention to devote myself entirely to methodology, and to set out the main types of statistical material and the chief devices for adapting it to the purpose in hand, which have actually been employed, with varying degrees of success, in different countries. In this programme I include some reference to the main differences of principle involved by different concepts of income aimed at, because such differences are often influenced by the nature, limitations, or absence, of the particular statistics

* "Wealth and Income of the Chief Powers," *Journal Royal Statistical Society*, 1919 (also in "Current Problems in Finance and Government"), referred to as "W.I.C.P."

required in detail. Even a preliminary survey shows how wide and varied is the range of material which may have to be pressed into service, from population statistics, occupational censuses, family budgets, area crop yields to insurance benefits, and we all know how many may be the pitfalls to be overcome when statistics which were prepared for one particular purpose are used in areas or for purposes quite unconnected with their original objects. The literature is large, and while I must review much that is common property and knowledge, in order to get a plan for the subsequent more detailed comment, I shall do so only in brief, treating such matters as are to be found in accessible appropriate and standard references. Otherwise it would be difficult not to become involved in the examination of the minutiae of particular estimates. The space given to the several aspects of the subject will, therefore, bear no necessary relation to their relative intrinsic importance.

2. *Definitions of National Income—Rival Concepts.*

These are as numerous as the estimates, and occasionally the differences really matter, because there is a difference of substance behind. I have no wish to go over this wide and rather familiar ground (70, 74, 15). Professor Marshall called the National Income "the net sum-total of things and services produced." Three reservations are necessary. This concept may mean produced in the country wherever the individuals may live who own it, or, more properly, it may mean accruing to the inhabitants of the country involved, which must exclude production going abroad, but brings in values accruing abroad to or received from abroad by those inhabitants. The second reservation is that only goods and services that are *exchanged*, or are capable of exchange, really count. Of course, a shopkeeper cannot deduct his own notional wage, or even the goods from his shop that he may consume, for that is "income." Similarly a small farmer paying himself a wage, either in money or in goods of his own production, must include them as his income. But when the production so consumed does not form part of a business for sale, *i.e.*, gardening in one's spare time, or production of values impossible to sell, the best convention is to omit the value. The household services of wives are involved, otherwise. However, a liberal view of the main convention is necessary when we are dealing with countries where small scale agriculture predominates, for the small farmer may consume practically all his produce. The third point has become more important of late years. We confine the idea of services to those rendered *during* the year, and a payment of interest or pensions out of the proceeds of taxation, for which the recipient renders no *current* services, must, for reasons to be explained hereafter,

be excluded. We do not ordinarily narrow down the national income concept to material output, and still less to the "true income" of Achille Loria, where personal subsistences of different kinds were deducted. We shall have occasion to note some practical differences of view in due course. But we constantly stumble across some new definition, such as this from Egypt: "la valeur des produits fongibles du domaine foncier (rural et urbaine) ce revenu étant majoré des revenus du capital et du travail engagés dans les autres formes de l'activité productive, tant à l'intérieur du pays qu'à l'étranger," and we have to analyse it carefully to see whether any new idea has crept in. The only special case that need be seriously looked at for the moment is the Hungarian, which is important.

De Fellner * (32) finds a rational principle for excluding services by a distinction between "lucrative-ness" in private economy, and "productivity in political economy." As the idea of national economy does not belong to the sphere of private economy, it is exclusively from the point of view of political economy it should be analysed. "Authors, including Bowley, Stamp, Flux, who consider national income as being the aggregate of individual incomes, start from a point of view belonging to the sphere of private economy and in calculating the amount of national income fall into the error of duplication by taking derivative incomes into account as well." The Hungarian conception is of the amount newly provided annually, plus, of course, income from abroad. He claims that it dispels all ambiguity and satisfies the requirements of practical statistics. His view is overwhelmingly supported by his countrymen, *e.g.* Földes, Navratil, Heller and Lang. My contention is that it gives an unreal conception of national well-being. The term "National Income" in Soviet literature refers only to the volume of national production of material values. We are bound, however, to discover differences of practical treatment even amongst those who are adopting the full concept, which can be traced back to underlying regard for some of the consequences of the "material" concept. American writers make no effort to distinguish such so-called derivative or duplicate income, except for interest on government debt paid out of taxation. W. C. Mitchell and S. Kuznets consider it is natural for countries in an early stage of development to omit services, and instance India (60).

3. *The Rural Concepts Tested Dynamically.*

In the dilemma between the materialists and the idealists, the former might seem to get the benefit of nearly every argument on

* *The National Income of Hungary, 1930.*

individual logical examples, but there is one broad general consideration which seems to me to be conclusive upon it. As civilization advances, it may well do so by the very fact that merely material production in wealth tends to render a less and less proportion of total human enjoyment. It cannot be said, for this reason, that the national income is stationary. Suppose that in one year three-quarters of the population are engaged in physical production and create a net product equal to 2,000 million sterling. Let us suppose that at the end of a decade one-half the people are producing this amount, and that, therefore, the average *physical* consumption of the people has not changed, but that one-half, instead of one-quarter of the population are then engaged in providing supplementary immaterial enjoyment, as singers, preachers, artists, lecturers, etc. Would it not be absurd to say that the national income in the two instances is unchanged, where the country has become so much richer in its annual flow of enjoyable things? Take a detailed example: materialists aver that if I receive £50 for a broadcast address, which gives great enjoyment to my listeners, I have not added to the national income. If, however, my £50 forms instead a part of the production of a book worth £250, that is an addition to the national income, though the enjoyment be the same, simply because it has called into existence £200 worth more of paper and binding. From the valuation of the books, the materialists ought certainly to exclude, to be logical, anything given to the author for his service. As a matter of fact, they get inextricably mixed up in their total valuation of services, whereas, to be strictly logical, parts of those services should be excluded; and they miss altogether the value of services which are not embodied in some saleable object. The balance of argument to me is overwhelmingly in favour of a conception of national income which puts full exchange value upon services rendered, however immaterial. I make one safeguard to this, viz. that in a community of very rich people, there may be a ring of services at fancy values, which undoubtedly enhances the totals. If they were important enough these ought, perhaps, to be reduced to their general average cost. In *British Incomes* I give the illustration of "A" a great surgeon, performing an operation for "B," a prima donna, thereafter "B" going to sing at a social function for "C," a leading barrister, and "C" taking a brief for "A" in a lawsuit. In each case, the service is generally rendered for £100, but on this occasion each sends a bill in for £1,000 and so the national income goes up by £2,700 above its figure upon any reasonable exchange basis.

We must beware, however, of falling into a fallacy. The high figure charged by a surgeon to a wealthy patient may be the reason

why very low fees are charged elsewhere, and it does not follow that such high fees are finally in excess of "cost of production," any more than railway rates charged on some classes of goods are excessive, when we remember that the product of the rate system in relation to the costs as a whole must be the test and not isolated examples.

I have expressly said that amongst our conventions it is only services rendered on an exchange basis to other people which can be regarded as producing income. This, no doubt, introduces an arbitrary element. If a hundred men have been to the barber regularly, they have no doubt produced a service income in addition to their own. Now if each of them proceeds to shave himself and the barber turns draper, should we not be justified in adding to the income of each person the services he now renders to himself? The answer is, of course, that the convention, while not strictly logical, is most convenient, because ignoring it leads us into metaphysical difficulties. But from this springs the more difficult question of "mutuality," and the service performed by a group of people strictly to each other in a club or society. If they agreed to give services without monetary payment on a basis of general equality, do they or do they not give rise to income for our purpose? This point would doubtless be a purely academic one but for the growth of the co-operative system, where it is held that profit made by the members "out of" each other, under the principle of mutuality, is not income. The question of degree is so involved that it might lead to one country, just as rich actually as another, but practising this principle to a greater extent, showing a less total national income; or it might lead to one country retaining a stationary national income merely because of the increase in this practice over a period of time, where its true income of services is actually increased. In a reservation to the Report of the Royal Commission on Income Tax, the question of mutuality becoming so "diluted" that it begins to assume the characteristics of the general community is discussed (65). So far no adjustment has ever been made for such a consideration, but it is getting within the reach of possibilities that such services ought to be valued and included.

4. *The Two Main Approaches.*

In one instance an *ad hoc* Census of Wealth and Income was taken, with interesting results which I have referred to elsewhere (71). The Commonwealth Statistician of Australia gave the full results in his report on the War Census of 1915. J. H. Sutcliffe, writing ten years later and producing an estimate on conventional double lines, has concluded that the Census was $14\frac{1}{2}$ per cent. below the true figures, and he explains that many people who completed it felt

that it might be used for taxation purposes and were either shy of giving figures higher than the lowest at any zone of doubt, or actually practised the same kinds of evasion as they would have done in a tax return. The nearest approach to this Australian experiment is the inclusion by New Zealand of additional questions in the ordinary Census, asking the individual to classify himself in one of seven income groups, the lowest being "No Income" and the highest "over £364." Obviously the last, by itself, is of little use, but coupled with the Income Tax statistics is capable of yielding some information, although farmers' incomes provide the usual stumbling-block, and the omission of house occupation from real income was a complication. A novel estimate of national income has followed; each group has been aggregated by taking the income at the arithmetic mean of the upper and lower limits—which does not, of course, accord with any known distribution formula. The results accord with the wages figures in the Report on factory production. Farmers were roughly estimated; a round figure of company profits not included in individual incomes was taken at 10 million £. No account was taken of Maori income, and owner occupier rental values and certain payments in kind were excluded (33).

Apart from these special cases the means and data generally available for estimating national incomes may be first divided broadly into the subjective and the objective, or perhaps better distinguished as those statistics which attach mainly to persons and incomes, and those which relate to things. For the national income, commonly expressed as annual, may be described as a flow of goods and services either *produced* or appropriated in a year, or as an aggregation of individual incomes *received* or due in a year, plus those receivable by corporate bodies and not divided amongst persons. Sometimes only one method or set of facts is available. Sometimes both are used and can check each other; sometimes the total estimate must be arrived at by the use of each over a part of the field, and their subsequent aggregation. Perhaps the best short nomenclature I can adopt is the "income" method and "census" or "inventory" method respectively.

5. *The Income Method.*

The income, "individual," "personal" or "subjective," method and data involve the following distinct types:—

- (a) The statistics of a personal income tax assessed in a total upon each individual, leaving, for separate estimation, the undivided corporate income.
- (b) The statistics of an impersonal income tax, which charges the founts of income at their source, *i.e.* companies on

their profits, before distribution; or the occupant of an office upon the salary attaching to it, regardless of his total income; or the rental value of a house, which covers the interests of tenant, owner, ground-landlord, and mortgagee wherever resident.

- (c) The statistics of wages, as such, to supplement or check (a) and (b).
- (d) Estimates of any classes of income "intermediate" between (a) or (b) and (c), such as small shopkeepers or farmers below the particular income tax limit.

6. *The Census Method.*

The Census, "aggregate Industry," * "real," † "inventory," or "material" method, comprises:—

- (a) A comprehensive sectional enquiry at particular selected years, of all manufacturers, and possibly of agriculture, (not divided specially for the annual income of recipients of receipts therefrom), and setting out either (Gross or Net output, or both. "End-product" is the latest American term (79).
- (b) A computation for intermediate years by means of index numbers of production, detached in industries, or as a whole.
- (c) An *ad hoc* "inventory" of particular trades and industries made especially for the national income computation.
- (d) A supplementary estimate of the value of services, professional, etc., not passing through the industrial machine, but paid for, out of net production proceeds, *after* they have become incomes (*i.e.* the so-called "duplication").

7. *The Impersonal Income Tax Statistics.*

The classic ground for the use of the statistics of the impersonal Income Tax is Britain, where it has been used for estimates of the national income for the past 100 years. An aggregation of individual incomes has not been available over much of the range, although at one time the number and amount of incomes up to £700 was roughly known, and the amount of incomes over £5,000 assessed to a global supertax after 1910 was also recorded. Attempts made to distribute the difference between the sum of those two parts of the scale and the total sum assessed to the impersonal tax led to strange anomalies, and interpolation by ordinary means on the Pareto formula led to an obvious "bulge" of an unsatisfactory kind (17).

* Sutcliffe.

† "Schätzung nach der überwiegend realen method," Waisner.

The explanation finally emerged that the total income assessed would *never* be found in an aggregation of individual incomes, and there would always be a considerable difference (68). This is probably true of all aggregations of personal returns. The difference is made up as follows :

- (1) Greater possibility of direct evasion in individual returns than in profits assessed at the source, *e.g.* the omission of a single dividend in a personal assessment is an irrecoverable difference.
- (2) Administrative indifference to the individual incomes at the lowest end of a scale, owing to the small sums involved—as indicated by the failure to conform to a fair statistical distribution.
- (3) Evasion due to bunching of incomes just below critical points in the scale at the expense of the numbers just above, much minimized wherever the effect of the stages or brackets for the progression rates gives a smooth and not discontinuous graduation in the tax (73).
- (4) Profits held in reserve by companies, etc. and not distributed to shareholders as dividends. (In certain circumstances, when times are bad and reserves are being depleted to provide dividends, the difference is reversed.)
- (5) Income of clubs and societies not traceable to individuals.

This unidentifiable income may assume considerable dimensions, say, even 10 per cent. of the whole. The practice of creating “one man companies” to minimize the distribution of income, while, at the same time, not alienating the wealth, but consolidating it into capital, has grown heavily of late years in all highly taxed countries, and makes the “personal income” method much less reliable.

The amount of “corporate income” not distributed by Companies, etc. may be determined by difference between the total profits and total individual declarations, by sample, or by guesswork. If a separate estimate is being made for evasion, the method of aggregate difference is rather precarious, for a difference between two large totals differently compiled, though small in relation to them, may contain other residual elements very large in relation to that difference. The estimate should certainly be checked by large samples of known company profits and distributions. In Bowley and Stamp (1924) it represented about 5 per cent. of the whole estimate. For 1931, Dr. Coates, dealing with *savings*, said, “no quantitative analysis of the aggregate is possible beyond the suggestion that in normal conditions possibly 30 to 40 per cent. of the total is provided by companies.”

In Germany, the recent official estimate gives an elaborate calculation, and shows that as much as 45 per cent. of certain trading profits were not distributed. For the four years 1925 to 1928, the percentage of the *whole* national estimate was, however, less than 2, and in 1931 there was a minus (or distribution of income in excess of current profits under this head).

For Japan the estimate was 6 per cent. of the taxable income similarly withheld from distribution.

8. *Aggregated Personal Incomes charged to Income Tax.*

The classic instance of the employment of this method is Germany, where the exemption limit originally was so low—900 marks p.a.—that a very high proportion of the total income of Prussia was included by this method, leaving a relatively small field to be estimated by other methods. Thus in Helfferich's pre-war estimate, 70 per cent. was covered and Rogowski's revision made in 1926 almost confirmed this, and his estimate for 1924 was not far short of 70 per cent. covered by the tax returns. But much of this apparent advantage was lost by the fact that the Prussian totals had to be brought up, assuming them to be representative, to a total for all Germany, on a population basis, by adding 60 per cent.

Helfferich certainly claimed to have made, for 1911, a "thorough examination of the assessment results in the other States," and to have been justified in applying this general average (66). But Rogowski followed this lead without any corresponding check, and most writers have drawn attention to the possible margin of error due to this. In any case the population figure seems to have been 61.6.

All past German work has now, however, been superseded by the monumental study recently published by the German Government (29), which for variety of material and method is an important addition also to methodology. The general effect is considerably to increase the 1913 estimate, through higher additions for undistributed profits and evasion, etc., and one feels at this stage the great value that would rest in a thoroughgoing check by the Census method. But the proportion of Prussia to the whole area is closely borne out on the population basis.

9. *Individuals below the Levels charged to Income Tax.*

The conventional method adopted is to estimate the numbers by deducting from the total population the numbers already dealt with, and applying to the remainder a multiplier of average income. Obviously both factors may be very obscure, especially if the population is handled, crude, without the refinements of age groups, occupational details, checks by houses, or by insurance or income statistics. In a like manner the average income may be a mere shot

in the dark, or it may be the result of very careful sampling, over the whole field, or part of the field.

In Japan, for example, we have the Government estimate of the untaxable incomes, on which a critical writer says, "In default of reliable data, there is no alternative but to have recourse to somewhat fallible methods, as, for instance, multiplying the number of those persons by their average income. It is, however, supremely difficult to discover the average income of such people, nor is it possible to know their number" (67). Such complete agnosticism is, however, rare. The earlier German estimates with a tax minimum of 900 marks p.a. assumed an average for this class of 750 m. without much close examination. But the more recent ones have a greater refinement. Thus Rogowski, estimating again for 1913, has the sickness insurance contribution in five wage classes, and is thus able to split the problem into three grades and to weight averages of 300, 500 and 750 marks respectively (64), giving a mean figure of 6 milliard marks—very similar to Helfferich. The recent Government estimate gives a different approach, with the limits for the seven chief States—the average for Prussia being 735 marks.

The British direct tax limit was at one time fixed at such a point that the wage-earning class was almost entirely cleared, without overlapping, so that the wages total could be separately computed and added, leaving an intermediate class of shopkeepers and small salaries to be added. But when the change in wage levels, post-war compared with pre-war, brought large numbers of wage-earners above the income tax level the problem was more complicated, and the "overlap" had to be carefully estimated. Again, when the effective exemption limit was materially lowered, *i.e.* from £150 to £100, the overlap became so large that the estimate for wage-earners below this limit became a different class of estimate altogether. For 1924, Bowley and Stamp gave 290 m. £ for 1,600,000 wage-earners within the tax limits and 1,310 m. £ for 13½ millions below those limits, while, for 1931 on parallel lines Dr. Coates (with Mr. L. R. Connor's support) gave 703 m. £ for 5,624,000 persons within the assessment limit and 707 m. £ for 9,960,000 people below (23).

Essentially, wherever the exemption limit of an income tax may fall, (a) some independent total wages estimate has to be made, and attention then concentrated on the "overlap" and its elimination; (b) a residuum of non-wage-earners or intermediate incomes must be examined, and (c) the most baffling section of this is the income from farming.

10. *Wages.*

It is impossible to say that there is any considerable common factor in the ascertainment of the total sum paid to wage-earners

in different countries, although the problem seems identical. The data available vary so greatly in the different countries, that no general method is possible, although in many of them a high degree of accuracy is attainable. It must suffice to summarize the methods adopted in two or three, to indicate the range of statistics and devices for handling them.

In Great Britain, for the Bowley-Stamp estimate, the original basis is the Board of Trade enquiry into hours and earnings in the chief industries in 1906. Bowley brought this up to 1911 in his *Division of the Product of Industry*. It was a single week in the autumn of 1906, used as a basis for a year, with allowance for unemployment and sickness, superannuation and casual work, and the net average annual earnings brought up to 1911 by the population census and total workers in each industry. This 1911 figure, 782 million £, became the starting-point for the 1924 estimate. The change in wage rates came from the *Ministry of Labour Gazette* monthly, checked by a special enquiry into rates and hours in 1926. The year 1911 was brought up to 1914 by 8 per cent. for population and rise in wages—845 m. £. The change in average earnings from 1914 to 1924 was then applied (90.6 per cent. males, 112 per cent. females) = 1,731 m. £, reducing by 76 m. £ for the Irish Free State = 1,655 m. £. Increased unemployment (from 3.8 to 8.3 per cent.), holidays 1 per cent., brought it to 1,564 m. £ (excluding sailors and soldiers). The evidence for the increase in wages rates was worked up piecemeal and *included* statistics from the Coal Commission 1925, an engineering report in 1926 and for textiles 1926 and many other sources. To bring the figures down to 1931, Dr. Coates used a 3 per cent. reduction for wage movements, a correction for gross population in the ratio 490 to 479, and for increased unemployment and short time, in the rates 80 to 90 (23). At a later date, Mr. Colin Clark approached the matter from a different angle. He took the *number* of insurable persons (health) and added the excepted occupations. The Census of Production gave the insurable earners, and other employments accounted for the balance. He then estimated the number from 1924 to 1928. By deducting the numbers insured in the Unemployment Scheme, the difference represented agriculture and domestic service. The Ministry of Mines returns and the Labour Wage Enquiry of 1924, together with the change in the number of insured employees, led to 1928 estimates, and by much intricate use of the other tests an effort was made to reconcile the numbers of the two insured categories. The emphasis is shifted from the Population Census as a fundamental basis to the social insurance statistics and the Census of Production.

In France, so far as the general movement is concerned, wages

are found in an annual official enquiry showing, in 38 male and 7 female "professions" in 200 towns, and 21 callings in Paris, figures which give an index of hourly and daily rates based on 1911. The Ministry of Mines gives figures for coal, other groups or public bodies collect figures for metal industries and electrical industries. Agricultural statistics are compiled in connection with accidents. The figures for actual wages paid exist only for certain groups, mines, railways and civil services, but certain totals available for accident insurance legislation officially given for 1928 and 1930 form a basis. Le *taxe d'apprentissage* gives another rough check to these totals. The occupational census is brought into service and "average" earnings applied to agricultural workers, and averages for other classes are determined from the monthly reports of labour inspection. Railways and public services are taken direct from the operating accounts (30).

11. *Intermediate Incomes.*

The intermediate class, not being income-tax payers or wage-earners, includes small shopkeepers and farmers.

When the income-tax level is high, the problem is important. It was sufficiently noteworthy in Great Britain to be the subject of an enquiry by a special committee of the British Association for the Advancement of Science (Sec. F). Bowley and I, for 1924, employed the following method:—

- (a) The numbers of occupied persons in different occupational classes were derived from the last census.
- (b) A percentage derived from birth and death rates was added to bring the totals to the appropriate year.
- (c) A percentage was added to adjust the totals for an area different from the census.
- (d) A sample was obtained by questionnaire to a number of private firms, including large employers in most industries.

In effect, it accounted for 9 per cent. of the totals, varying from 32 per cent. in the best to 2½ in the worst, which was average income for the class under £150 in each section, which was applied to get income totals for each class. (The samples were tested by the conformity to theoretical type distribution.)

- (e) For Government and other officials an *ad hoc* estimate was made of the proportion of the total numbers falling below the limit.
- (f) Small farmers were separately estimated.

Dr. Coates, in bringing the estimates of 1924 down to 1931, found

it necessary (owing to the income-tax limit coming down much lower) to "devote little attention to it." Instead of two millions with an average income of £133, he was able to deal with one million with an average of £80.

So far as income from small agricultural business is concerned, even in the case of fully accredited income tax statistics the farmers' incomes do not appear well authenticated, and a realistic check is usually applied. In Great Britain, the classification (in averages) of agricultural holdings, by number and total area, is used. Sufficient of the larger holdings are taken at an average rental to give the taxed aggregates of farm products, and the remaining holdings are reckoned to be untaxed. The total number of farmers thus indicated is compared with the occupational census totals, and an average income appropriate to the average holding is assumed.

The difficulty is especially important in its influence on national income totals, where agricultural income predominates, as in the Irish Free State, for the small farmer is practically a personal wage-earner (47). Land Valuation, and the Schedular Tax based upon it, is of very little value. The *net* product method (derived from Gross output at retail prices, with purchases deducted, and rents, but *not* wages) brought out 58½ m. £ against £1,284,000 assessed under Sch. B. of the Income Tax. The income from occupation of land was eventually taken at 56 millions against 3½ millions for ownership. Valuation only comes into the picture for non-farm property.

In Australia, the Labour Department reports give average wage rates, in general, for industries, and for males and females. A weighted average is adopted, and a percentage deduction for unemployment taken. There is an overlap with income-tax payers, which is eliminated by estimation. In general it may be said that occupational censuses, special wage rate enquiries, periodical reports of changes in wage rates, insurance statistics, and various taxes on wages, with a reconciliation with population growth statistics, provide the broad general basis for these estimates.

12. *The Census Proper.*

The term "census" connotes individual returns of activity to be aggregated by the authority charged with the duty, and these may be in *values* without close description of the detailed products, or in quantities of products leaving the monetary equivalents to be superimposed. We may term these "Value Census" and "Product Census," respectively. Where the information is not collected from individuals but is worked out from statistics of area, average produce, etc., the term "census" is inappropriate, and I prefer to borrow a term from

capital, and call the computations "Product Inventory" and "Value Inventory."

The British Census of Production obtains no direct record of goods. "The record of the output of manufacturing establishment groups together goods ready for final use by final consumers and goods which serve as a starting-point for further manufacturing operations *—the proportions are not known. But while the returns of "gross output" when aggregated contain much duplication, the "net output" returns are practically free from it, and can be added together with impunity. "The net output of any industry is the fund *from which* wages, salaries, rent, royalties, rates, taxes, depreciation, advertisement and sales expenses and all other similar charges have to be defrayed, as well as profits." So far as duplication is concerned, goods go out of one industry at the value at works, but come into the next industry at the value at the new place, which is greater by the cost of merchandising and carriage *between* them. This leaves the profits of the intermediate stage to be separately accounted for. In the Hungarian Census the opposite method is followed, and fuel consumed is reconverted in price at the colliery instead of the factory, and timber at the forest (32). A computation is then made for a deduction from the profits of commerce and transportation.

The precise differences between the technique of this census and that in the United States are too large a subject for this paper. The United States Census since 1905 has omitted the hand industries and covered the factory industries, at first quinquennially and now biennially. The British Census is at much longer intervals and presents a greater difficulty in interpolation for intermediate years.

The detailed comparison of the Census of Great Britain and the United States has been made by Mr. Flux recently (36). The pairs of years for comparison are 1924 and 1925, and 1930 and 1929 respectively. He shows the differences in the scope of the industries included, and the effect of bringing in *public* enterprise in the particular industries for Great Britain, with many interesting contrasts in the results of net output, but he does not devote himself specifically to the part that each census plays in the National Income Estimates, and the steps taken to prevent overlapping. An elaborate study of King's "net value products" in the National Bureau estimates has been made by Professor Copeland recently in "Some Problems in the Theory of National Income" (27).

- (1) King's deduction for operating and maintenance expenses paid to other enterprises for materials, supplies and services, includes a part of rent, and a part falls to be paid out of

* Flux, "The National Income," *Journal Royal Statistical Society*, 1929.

the net value product—tantamount to separating lessees and lessors. Copeland prefers to group all together in the unclassified income group.

- (2) Compensation for damages to employees is treated by King as coming out of net value product, but by Copeland as depreciation of human resources, and as a deduction.
- (3) He considers the scheme works well except for banks and financial enterprises.
- (4) There is much shifting about of property income paid to, and received from, other enterprises.

The Hungarians claim to be pioneers in Europe of industrial census taking in 1898. Since 1921 they have published annual results of systematic production statistics. The results are not, however, strictly comparable over the years because of (1) currency changes, (2) greater efficiency in giving information, (3) inclusion of larger numbers of factories, (4) a change of test for inclusion, from a man-power basis to a combination of man power, mechanical power and amount of production. The general principles of the census are similar, but the quota of wear and tear is completed as a percentage, 1.72, of gross value apparently on the basis of a detailed calculation in 1916.

13. *Intercensal Years and Extrapolation Generally.*

When a detailed estimate has been made for particular years it is often desired to bring it more up to date for years in which the basic particulars are lacking, or not yet available, or to fill in the figures for intercensal years, in order to enable some comparisons to be made with other statistics. Occasionally the methods employed are very broad or crude, and actually or virtually move the whole total bodily. In an Australian estimate, a detailed interpolation really results in moving the whole estimate of national income exactly with the movements of the annual census of production (77). In Germany, some comprehensive methods of "bridging" by income index numbers have been elaborated, and, so large is the basic factor of income, this may approximate to a corresponding movement of the whole estimate.

The chief materials for the bridge, or for extrapolation, are samples of profits, foreign trade figures, the index of production, unemployment statistics, the wages index, and, of course, population.

The samples of profits published by the *Economist* have been used for extrapolation by C. Clark and Dr. Coates for Great Britain. The latter moved the estimate of total profits assessed to tax forward seven years by this means. It is of course subject to subsequent

check of accuracy, as the Revenue figures are published some three years after the actual trading year to which they relate. I have combined the two sources in a Profits Index dating from 1920, with 1924 as a base.

The use of import and export figures, with their great advantage of being so up to date, has been commended by Mr. Flux, as an attractive method, in the absence of any large change in the general structure of a country's economy, for computing intermediate figures of national income.

Mr. Flux has also begun the inevitable procedure of getting post-censal figures for production by the use of the new Index of Production (35), and this will obviously reach a crucial test when those years lead into a new full census year, and the results so projected are put to the test of facts. That test should lead to a revision of the Index itself as a proper record of industrial change. It will be interesting to see how far accuracy in the projection depends on splitting up the total index into its sub-indices for application to separate sections of industry, and how far sufficient accuracy is obtained by using the index as a whole.

In fact the time is now ripe for a thorough-going examination of the results of interpolating and projecting devices. The absolute estimates for particular years, not too far apart, should afford the necessary terminals, and it should be seen to what point, by projection or extrapolation, the first estimate would reach, compared with the second or terminal absolute estimate. Great divergence may or may not lead to modification of the index numbers used, to make them truer guides to facts, but obviously no amount of divergence could be pleaded to alter known series, such as import and export totals, population statistics, or railway tonnages or receipts—one can only conclude that they are good or bad guides for the purpose. I made a preliminary attempt some years ago to determine the degree of correlation between different series and profits or incomes in a paper given to this Society. But this correlation must be continually redetermined, for economic trends change, and even when it is high it may not be reliable for very long. The risk of error is very great, and unless we have several convergent series giving similar results, or unless there is an absolute test or support, we may be "let down" quite early in the extrapolation. I have already given an example of successful use for Ireland 1842-1852. Mr. Colin Clark recently found a coefficient of .86 between the Sauerbeck Index number and Great Britain's income from overseas investments 1922-31. Dr. Snow showed that if this method had been used to compute 1922 there would have been a difference from the directly computed figure of 30 millions or 15 per cent. Census of production

figures have been interpolated and carried forward by the use of unemployment statistics in separate industries, with a price factor, and a factor representing the increased physical volume of gross output per employed person (Clark). This is obviously safer for intercensal years than for extensions and has been criticized in the outcome. The price changes, in particular, must not be regarded as making all the factors of the census, such as gross output and net output, move in the same proportion.

Price changes are, in fact, much more than quantity changes, the real difficulty of extrapolation. Private incomes from business were carried forward by Rogowski on a basis of population and a price index, with a great element of doubt. But even numerical changes of classes are not easy to handle. Extrapolation of the numbers of employers and independent workers for any distance on the basis of a prior trend, was shown in the light of actual census results to be risky—such a calculation gave an increase of 14 per cent. against a proved result of 17 per cent. decrease (Snow).

In the case of wages, an absolute total is so seldom obtained that extrapolation is a common and necessary method, especially where the income or wage tax minimum is so high that taxation figures give no help. I have already referred to the original bases in Great Britain and the projections by wage indices etc. twice adopted by Dr. Bowley and myself, and also the later projection by Dr. Coates. C. Clark has brought in a new absolute test of numbers (rather than wage amounts) through unemployment and other insurance figures, which show important differences.

Very elaborate sampling gives the relative yearly figures for the United States, and the annual trend is well established and the occupational census checks the numbers from time to time to which the trends apply. But with the varying factors of unemployment, short time, nominal wage rates, hours of work, total numbers in each class; the value of an occasional actual wage earnings census, with absolute figures, is obvious, for the purposes of an estimate of national income as distinct from a variation of pay rolls when the presence of a constant absolute error is unimportant.

14. *Inventory Estimates—Agriculture.*

In Britain, the appropriate Government Department has undertaken enquiries on a voluntary basis, coming under my head of "Product inventory," which, when priced, gives the value "at farms" of each category, and the detailed description I pass over as being readily accessible, in the official publications.

The United States has a Census of Agriculture which, together

with the reports of the Federal Bureau of Agricultural Economics, give the data for a very close estimate. The census was taken in 1925, and small farmers constitute some "three-fifths of all entrepreneurs. It is fortunate that the single field for which fairly reliable information is available is the largest of all entrepreneurial groups" (77). It is obvious that the method depends upon the intervals at which such a census is taken, and the accuracy of the estimates or other devices for computing intercensal years. It has been claimed for Australia (where nearly 70 per cent. of the whole is agricultural, etc.) that the "annual statistics of Production published by the Commonwealth Statistician are more complete than those published at annual periods in any other country." Even the periodical censuses of the U.K. and U.S.A. are no more complete than are those published annually in Australia." The figures in no instance known to me, certainly for intercensal years, represent actual receipts, but total values computed on the basis of average prices at particular dates. King took monthly sales and prices (49). The expenses are derived from the census particulars, especially for fertilizers, which in the States in 1919-21 worked out at about 15 per cent. of the gross income. The elaborate U.S.A. estimates bring into the computation gains and losses in inventory of farm land and property, which covers not only values of crops on hand but also actual variations in the values of farms, on the principle in Section 19.

The Irish Free State estimates also give the output at retail prices derived from the gross output, taking stock changes into account, because the special nature of agriculture there makes them include the *retail* value of farm produce consumed by farmers. It is not general, however, to make a large retail profit out of oneself, for inclusion in the national income (47).

In Australia the prices used are those at the cities, and these include a good deal of merchanting and transport profit (assumed to be one-third of such profits) and the deduction for renewals and replacements is 10 per cent., copied from Great Britain without comment (77). In France, the profits of agriculture, until the results of the general agricultural enquiry are known, are dependent on the *Statistique agricole Annuelle*, which, while often seriously criticized, has, at any rate, "le mérite d'exister." The figures of gross "végétale" production are priced and the consumption for annual production estimated. The wages previously determined for this class are deducted and a further subtraction made for working expenses (based on the 1882 and 1892 enquiries, but now raised for the heavier modern use of machinery and fertilizers). Seven per cent. is deducted for sowing, and general expenses come to 25 per cent. of the remaining 93 per cent. gross production. Deterioration

of implements and stock and buildings is not taken into account in the Russian estimates.

"The estimates of national income which take no account of qualitative deterioration cannot present the actual dynamics of the physical volume of national production" (11).

Where a census of agricultural produce is not available, estimates have been made for the product, on a population basis and sample family budgets. Thus, for Egypt, Dr. Levi used the details collected by T. L. Bennett for a cost of living index of family budget consumption of meat, milk, butter, cheese, fowls and fish, taking the unweighted average of two classes of budgets, and multiplying these quantities by the population figures and pricing the results at wholesale with allowance for transport. The results were severely criticized by Baxter as involving total expenditure by individuals double their earnings from all sources. It is interesting to see what a wide range of statistics may be pressed into service when we find Mr. J. I. Craig, the Controller of Statistics, defending Dr. Levi, by the use of food values, taking the energy calories, the protein and fats contents of the average budget, and checking the totals against the known results elsewhere, after making allowances in the calories totals for climatic differences, and finding that the budgets were not only consistent, but that the work of the individual could not have been done on much less. He also appealed from dietetic evidence to show how the average consumption of the clerk and artisan classes might be applied to fellahin and others.

Vandellós gives the estimate for agriculture in Spain as follows:—average figures 1903–12 for harvests collected by the *Junta Consultum Agronomica* were reviewed and corrected arbitrarily; in view of a percentage of 30 per cent. used in France in 1875 and 25 in Italy before the war, he then adopts 27½ per cent. as Spain's proportion for capitalization, but in computing his income tables, takes the full production. The other categories are all derived by multipliers in five classes: agriculture, animals, mines, industry and commerce. The figures for 1923 involve taking revenue as 25 per cent. of agricultural production to get capital values, and revenue is obtained by "la méthode des multiplicateurs pour arriver à un résultat probable."

For Portugal, what he calls an approximate figure is arrived at on model lines. A writer, Ponsard, in *Le Portugal inconnu*, gives the story of thirty-five families, and for twenty-one computes the family income, and guesses another nine. From this, Gini found an *average* family income, which has been taken as a minimum, and applied to the whole, on a population basis, there being 160 people in the sample, and 6,100,000 people in Portugal, thus giving 435,000

contos, which was raised to "450,000 to 500,000," on a comparison with Spain (81).

Another very hazardous method is to reach a capital value of wealth as a whole, or landed wealth in particular, from successions, by using a multiplier representing the devolution through mortality rates, and then reckoning an arbitrary percentage on this for the annual yield. This was followed by Barthe for a pre-war estimate for Spain—he used the multiplier 37 and $3\frac{1}{2}$ per cent. as the income, but without any enthusiasm concerning his own results. He was aware that the multiplier always gives too low a figure, and invented a "co-efficient of evasion," which he thought, for Spain, ought to be substantial. But finally he presented his results for wealth in the usual inventory form:—Agriculture 40 per cent. of the whole: Animals, Houses, Industrial establishments, *mobilier*, precious metals, industrial values, reserves *en magasin*, public debt—surely as strange a grouping as we shall find. Vandellós, estimating for 1924, kept much the same framework (81).

The general estimates for Russia are based on government statistics of production, but one endeavour was made by Litoshenko in 1925 based on income return, wages, workers' budgets, etc. (11).

16. *The Duplication Problem.*

Under the heading of duplication comes the question of incomes paid out of taxation. Personal taxes such as an income tax are not deductions from the gross income out of which they are paid, and the higher the income tax and the more the number of people employed by the State, the greater will be the total national income reckoned by our primary principle; whereas, of course, there may be no corresponding increase in the total quantity of physical goods to be enjoyed—they are merely distributed between primary and secondary earners. In this sense we are at once in the realm of duplication for services, and an excessive number of Civil servants may be exactly parallel to an excessive number of doctors. Even if the tax expenditure takes the form of encouraging physical production, it may be said to be only substituted for the physical production that would have been required by the taxpayers if they had not been so highly taxed. To pass from this question related to the nature of services, it is more important to look at the form of the tax. A Customs Duty may be said to absorb part of the purchasing power of the individual, just as much as an income tax, and, therefore, to have a similar effect. But it is not so clear that a tax which is allowed as a business expense in computing income for tax has this result. Let it be supposed that a business with a profit of £10,000 a year is charged with £1,000 for certain essential national services,

e.g. State doctors for the wage-earners. The national income will fall in this regard from £10,000 to £9,000 unless the £1,000 earned by the doctors is added. What has happened is that the total produce being the same, the owners of business are entitled to enjoy less, the wage-earners enjoy the same and the doctors enjoy an amount which, by hypothesis, they did not have before. The alternative way of doing it would have been for the full £10,000 to be distributed in dividends to the business owners as income, and for an income tax to have been levied upon them to the tune of £1,000, out of which the doctors were paid. In the first instance, when the doctors were idle, the national income was, say, £30,000; in the second instance it was £29,000, unless the £1,000 earned by the doctors was added in again, making it £30,000. In the third case, it is £30,000 until the income of the doctors is added in, when it becomes £31,000. It seems clear, therefore, that services *must* be added in where they are met by direct or taxing payments charged in industry, and reducing its profits, and that when paid by direct taxes not charged to business, whether they should be added in or not, and not reducing incomes, turns upon the same point as duplication for services already considered.

After writing the above, I was amused to find the point, and the doctors, anticipated sixty-five years ago in an International Statistical Congress:—

“Supposons que les médecins ne reçoivent pas leurs honoraires du malade même, *pour chaque service rendu*, mais qu'ils fussent salariés par le public (l'État) pour donner leurs secours gratuits (comme cela a lieu effectivement pour les médecins militaires). Le résultat quant à la société serait évidemment le même, mais ce revenu ne pourrait être considéré comme une part du revenu national qu'en défalquant la même valeur des autres revenus dans les parts d'impôts; peu importe que le paiement se fasse ou non par l'intermédiaire de l'État.

“On demande donc—pour trouver le chiffre du revenu national par l'addition des revenus individuels, s'il ne faudrait pas se tenir strictement aux revenus obtenus par la production immédiate d'objets échangeables; en d'autres termes aux revenus, prix des services productifs dont la valeur peut se retrouver dans la richesse produite par l'analyse des prix de revient.

“Ce point de vue exclusif n'aurait rien d'injuste pour les producteurs dits *immatériels*. Leur travail est de la plus haute importance pour la production matérielle en général, principalement comme cause et comme auxiliaire de production future. Que deviendrait à la longue la production si on négligeait la santé, la science, la discipline de la jeunesse; si on n'élevait les cœurs, si on n'annoblissait les pensées, la vie sociale et même les délassements?

“Évidemment le niveau social baisserait et avec lui le résultat productif.” *

It is generally agreed that payment for rent of houses is a way of spending one's income, and not a reduction of income, while to the recipients it certainly represents income. Now this conception gives rise to two difficulties, first, where no rent is paid except by the owner to himself, the view taken in some countries is that there is no addition to the national income, but a strict parallel to the first case adds the rental value of the house occupied by its owner to his income. If this were not so, the national income would vary without any change in the outward physical assets enjoyed, as men moved in and out of each other's houses, and the arbitrary act of renting houses to each other would change the national income. This argument determined King to include “imputed income” (27). [But the latest official American estimate omits it with the comment “there is some doubt as to the propriety of including this item, since the ownership of a home combined with its possession does not constitute a participation by the proprietor in the economic activity of the nation in the same recognised fashion as does his work for wages, profit or salary, or his capital investment in industry” (79).] On the other hand, why do we single out a house as the only item of capital assets enjoyed by the individual, which gives rise to an unseen annual income? Why not his pictures and his furniture, his books and even money spent on his education? The rejoinder of the materialist is that we get into this difficulty the moment we depart from the objective scheme. The only safe income to reckon is the materially produced income. Renting a house redistributes this, but does not alter its total.

When a new house is built out of savings, the expenditure does not diminish the income of the owner, but at the same time it creates income for those engaged in building. The objective parallel is that the owner consumes less consumable goods but more bricks, whereas if he had not built the house he would have had the same net objective production in consumable goods, while the income of the producers would have been the same, because instead of building a house, those engaged thereon would have produced his extra consumable goods.

In my *British Incomes* I face this dilemma by saying that as the renting of houses was customary, its income-producing capacity could not be ignored, even though it only provided an annual service (and not a new supply of goods), and it was more convenient to assimilate owner occupation to this state of affairs of service in rent than to blot out such service income altogether.

* *Congrès International de Statistique à La Haye*, 1869, première partie, p. 141. Revenu annuel de la nation (Rapporteur M. J. L. de Bruyn Kops).

The income received by individuals from Government interest paid out of taxation is the one section of duplicated income that should be clearly distinguished. The same problem arises in estimates of national wealth, as to whether the capital value of the debt, which is wealth to individuals, should be added to the capital values of all other physical assets. Giffen at first considered it a duplication; later, that the value of the other property, subject to a hidden mortgage charge through taxation, was diminished. Before the war, I examined this contention in detail, and concluded that there was a partial duplication, but afterwards I dealt with the matter as one of degree and refused to admit that the "bigger the debt the bigger the income" (71). Bowley and I made an express exclusion of this interest payment, as not being given in return for any current services, a mere redistribution of produce for some past *quid pro quo*. Our distinct computations for aggregate income, disposable income, personal income and social income made full allowance for these distinctions (74). The exclusion is recognised by American writers.

Morris Copeland accepts the British method, and in analysing King's figure says, "whether King is right in including interest on our domestic war debt as an item of national income, depends upon the incidence of taxation which services this debt. If these taxes (1) fall on other properties, (2) cannot be passed on, (3) become capitalized into discounts in the value of the properties, we may fairly argue that the interest should be included . . . theoretically, the case against including it seems fairly conclusive. . . ." Practically he wishes to determine which part to exclude.

On the analogy of house ownership not being converted into new national income by the mere process of mutual letting, he concludes that national income should not be decreased by a mere increase in government ownership. "We have, with Stamp, argued against King's concept, but on different grounds, viz. the need of a reasonable relationship between income and wealth" (27).

On similar lines, the British estimates exclude pensions, which, in so far as they come out of taxes which have not been deductions in arriving at other people's incomes, swell the totals. No *current* services are being rendered, so that the duplication that would be permissible if a doctor were paid out of taxation income is not allowable. If the pensioner, or the war loan interest, were paid direct by the citizen instead of out of taxation, the charge would reduce their taxable income, but the doctor's charge would not, so that the method is completely consistent. Rogowski seems to agree in principle to exclude war pensions and interest on non-productive debt, but it is not very clear whether he has actually done so. Relief and charity is a mere redistribution, and if specially included, for

the recipients, would be a duplication, except where it is paid by a business which can treat it as an expense (79).

The severely objective view of national income taken by Fellner, for Hungary, leads to a strange consequence in dealing with income from travel. He computes that 173,000 foreign visitors, crossing the frontier, spend in railway fares 45 pengos per head, from which he computes the addition to the national income. The rest of their spending has already come into the proceeds of production. (The passenger fares of residents have been ignored under his definition.) Then he proceeds to make a deduction from the national income for what Hungarians spend abroad. In the absence of better statistics, he computes from the railway ticket coupons dealt with, the money flowing from Hungary into foreign countries for summer holidays, and deducts the result as a liability. Apparently the wealthier Hungarians become the more they will take such holidays, but the national income must be blind to additions to the incomes so spent. He quotes Gurtler and Winkler as objecting to this conception, because it is merely a method of consuming income. Fellner answers them in detail, concluding with the words, "Travelling expenditure of citizens of the country spent abroad has the same effect as payment of interest to persons residing in foreign countries, which payment diminishes national income."

In the Russian computations excise duties have been excluded "because they do not constitute a part of the value of national production." Income from road transport is partly included in the income from agriculture, as the latter is calculated at market prices and not at those obtained at the peasants' homesteads, and partly included in income for trade, which also includes transport expenses. It is therefore excluded as an independent item of national production or income.

As an odd example of the duplication argument I may quote :

"Mr. Baxter would have the cost of the Irrigation Service omitted from that part of the income which arises from payment to Government officials, since it is already included in the cost of raising crops and must not be counted twice over. Why does he not equally demand the reduction of the national income by, say, part of the cost of the Ministry of Justice, of the police, of the army and even of high officials in the Ministry of Finance? Without justice and without the protection of the police and army, and without the skilled advice of the officials, it would be impossible for the fellah to produce the crops he does. The reason is obvious. They all perform real services, and these must be added to the national dividend at the value placed upon them by a hard-hearted Treasury . . . the produce of the land, labour and capital of the country

consists of certain commodities and certain services . . . quite indefensible to consider they have been included in the income measured by the material produce" (28).

17. *Causes of differences between the Methods.*

Values by the objective method through a census, and by the subjective method through profits and wages, should theoretically coincide, but owing to the conventions upon which profits are computed, there may be important differences at times when price levels are rapidly altering. First, the profits for a year are affected by the methods of valuing the stock at the beginning and end. Stock-taking is a device for eliminating the cost of manufacturing a thing which has not yet been sold. The census normally takes gross output at its sale price and, therefore, brings in unrealized profits on goods that have been made. A profit and loss account ignores such profits. If the quantity at the beginning and the end of the year is the same, there is no difference between the two methods. But if the quantity has materially altered on advancing or declining trade, the difference may be important. Again, if the price has materially fallen, any ordinary accountancy method writes off against the profits of the year, through its valuation of stock, a secret reserve for the loss when it is made. By not taking into account unrealized profits, by dealing with differences in quantity and differences in price, in a time of rapid movement results may emerge which give differences between the two methods.

The second element relates to the elimination of bad debts, against which, in bad times, there are special precautionary reserves. These do not necessarily appear in the census. Third is the difference between depreciations and renewal, and a census may show repairs and replacements of a very small amount where accountancy spread over a long life makes a heavier charge. Many taxation systems give a heavy allowance in the early history of a plant and a small allowance at the end.

In the fourth place, profits for taxation in computing payments that go out from concerns to others are not necessarily the same as the payments that come in, whereas all such transfers of goods in a census will cancel out, for the taxation rules about computation of profits treat some payments by the payer as capital and by the recipient as income, and others by the payer as expenses and by the recipients as capital. My own conclusion in considering the British case between the estimates of Dr. Bowley and myself on the subjective method, as against Mr. Flux's on the objective, was that the income method was almost certain to fall below the census during times of business

difficulty. This view is recently confirmed by the official American report (79).

On this confusion about personal services, Dr. Coates has pointed out that it is difficult to know by what means the spending part, *i.e.* payments for private journeys, are separated from the earning part, *i.e.* payments for business journeys on the railways. This fact alone would make the estimate of service income extremely difficult to reconcile.

Professor Gini has said that a moving national income could not be measured for the same reasons as a moving object could not be weighed.

18. *Territorial Divisions and Adjustments.*

It is sometimes necessary to apply the statistics compiled for a particular area to a wider or narrower area or to use them as a basis. The computation of the individual incomes for all Germany from the Prussian totals is the most important instance, and it has been done by a straight addition of 60 per cent. on a population basis by several writers. Reductions of pre-war Germany estimates to post-war areas have been similarly made on a population basis.

For comparative purposes, when the Irish Free State was formed and the statistics of the United Kingdom were thus affected, it was often assumed for official computation that a deduction of 4 per cent. from the aggregate would be a satisfactory adjustment. This was based on a combination of various tests and valuations. When an independent calculation came to be made for the new area by T. J. Kiernan, it proved to be practically 4½ per cent. From 1842 to 1853 there was no income tax in Ireland as a whole, and to establish a notional total of income tax liability for eleven years for inclusion with Great Britain, so as to get a comparable sequence, I constructed an index-number made up of a consumption index, an external trade index and a finance index. The first comprised twelve elements with continuous statistics, quantities of spirits distilled and charged for home consumption, bushels of malt charged, four kinds of licences for liquor, licences for tea and coffee, post licences, tobacco dealers and manufacturers, attorneys, motors and conveyances; the second sub-index was based on the note circulation, and the third upon exports and imports, coasting brand, tonnage cleared. This index gave a difference in a post-1853 control or known period of 0·4 per cent., with a maximum difference of 4·7 per cent., and a modal difference of under 1 per cent. It was then applied to carry back the known Irish figures from 1853 to 1842. I also assumed that the same percentage of Great Britain obtained before as after 1853, and took a mean of these results which were generally close. Elements other than profits presented less difficulty (70).

Perhaps the most elaborate area division that has been attempted is that of the estimate for old Austria, into its successive States as at present constituted, made by E. Waisner, working upon the estimates of Fellner, Gurtler and others. It employs many devices for the territorial allotment of the various figures, including area, stock and population, and shows clearly that such divisions do not lend themselves to general principles but depend upon the extent to which auxiliary statistics are available (82).

19. *The Element of Capital Value.*

American writers have included the rise in the market value of capital assets under income (or the fall as a deduction) (48, 49), but the practice is not generally accepted in other countries. It is abhorrent to British thought, with its sharp taxation distinctions between income and capital appreciation. Morris Copeland (27) shows how the practical difficulties stand in the way of effective use, but his objection to including scarcity appreciation as an item in total wealth is that it is "valid or untenable according to the type of total income under consideration." The British concept of savings is the excess of money income over actual consumption in the year, regardless of a depreciation in the value of the main body of previously existing assets not being actual wear and tear but market value changes. The American or "King" concept estimates savings after allowing for such depletion of capital values.

Copeland analyses King's concepts of realized and accrued income. The realized income is not entirely a consistent idea, but a compromise. In agriculture it *includes* business savings before taking account of the changes of market values of farm property. In the other groups, business savings are omitted. King desires to give a figure in realized income for year to year comparison which is not dependent on the doubtful items "business savings" and "appreciation." When King seeks to diminish or increase business savings by the changes in capital values, he departs entirely from the concepts adopted in any other country. Copeland considers that the objection to including scarcity appreciation as an item in *total* income is valid or untenable according to whether the type of total income under consideration is accrued income, in deflated dollars, or current dollars—an almost metaphysical distinction. "King uses increases in market valuation of securities, less new money invested, as a basis for estimating business savings in important industry groups." The shift from a book value basis to a security market value basis is due partly to defects in existing data, but also to King's view that book values do not move sufficiently with price changes. Copeland criticizes *not* the main principle, but these means for expressing it.

I remain an unrepentant believer that it is all very confusing and unnecessary, and am not very sympathetic to the mass of difficulties which attend its practical application. I can only repeat my original objection,* "with our much clearer cut concept of the distinction between income values and capital values, this process seems very artificial and un-English, but it is 'all of a piece' with the strange compound of capital changes and income in the American system of taxation. We ask why there should be any difference if £100 of profit is distributed and £20 put back by subscription of new capital into a business, and distributing £80 and keeping £20 back for business expansion." One of the Directors' comments was that "it is difficult to imagine a case in which the total figures, including the inventory gain, would be useful." As the rate of profits increases, the capital values based thereon (as an indication of future income) increase too, and to reckon both is to get it twice over.

Here I must leave the question, so dependent upon national psychology and systems of taxation.†

20. *Reconciliations.*

When the two main methods have yielded their results and are brought into comparison, what may be expected to result? Can it be said that one method invariably gives higher totals? Is the proper course to "split the difference," or what combination should be made? Hardly any attention has been given to this as a separate problem, and they tend to be equally valued. Dr. King tells us that when he prepared the objective estimate and Dr. Knauth the personal ones, independently, "it was an exciting moment when the two sets of totals, each covering the years 1909 to 1918 inclusive, were brought together. All concerned were much gratified when it was discovered that the difference between the two estimates was in no year of much consequence" (49). Over the nine years 1910 to 1918 for which the estimates were comparable, the Production Total averaged 40.2 billion dollars, and the Income Estimate 39.5, or 1.7 per cent. The highest difference was in 1913, 6.9 per cent., and in two years there was identity. The British totals were brought into juxtaposition at the Royal Statistical Society. For 1911 the Personal was between

* *Statistical Journal*, 1927, p. 165.

† On the day of reading, the latest official publication was received from Washington (79). In this, the whole method has been abandoned: "the inclusion of gains and losses yielded by such changes in asset values would be either a duplication, since it would amount to counting both a change in net income, and the change in capitalisation of that income, or a distortion of the national income estimate as a measure of the economic system's end product." It seems clear that the publication to the nation of figures of national income already heavily diminished, but reduced to a minus quantity by the special deduction of the huge shrinkage in capital values for 1932-3, was too much for any realistic official statisticians to face!

2,050 and 2,150 m. £, and the Census 2,000 to 2,250. For 1924 Bowley and Stamp's estimate was from 3,700 to 3,900, and Mr. Flux gave 3,750 to 4,200 m. £, the middle points being £3,800 and £3,975, about 4½ per cent. difference. Waisner, for Austria, brought out Real and Personal totals, with the latter just 1 per cent. in excess. *Vierteljahrshefte zur Konjunkturforschung*, 1930, Heft 4, contains estimates, 1925 to 1929, under six heads, inventory fashion, and then "Methodische Erläuterungen" depending on tax statistics for incomes, wages and corporations. The results of the latter are not summarized, the estimates resting on the objective method, but on examination and aggregation they are found to tally closely (54·3 to 54·9 md. R.M. for 1925).

A New Zealand estimate was content with 137 m. £ by personal methods against a value of material production 113 m. £, adding 20 to 40 m. £ for personal and professional services, so that "confidence in both the estimate and the census is strengthened." But his colleague Sutcliffe, in Australia, made a much closer job of it, for the estimates were within 0·3 per cent. For other derivative years the differences were 2 per cent. over five years, 1 per cent. over four years.

Dr. Reichlin brought out Swiss estimates at 5,700 (Personal) and 5,300 (Real) milliards of francs, and adopted the mean figure.

21. *The Price Change Element—Capital Values.*

Various countries have been much concerned to reduce the *money* aspect of national income to comparable real incomes, even if the basis of the estimate is not "realistic," so that an objective character may be given to differences over a period. Where the changes have been rapid, as in Germany after the war, the difficulties are very great. Rogowski alters the figures for employment and interest on current prices. The monthly returns of tax from employments were corrected (1924) by monthly mark values, then divided by the average rate of tax, with additions for abatements and employers' contributions.

The statistical method employed officially in Russia since 1918 has been to compute the national income for 1913 at 1913 and 1900 prices, and by price indices since to adjust the later money totals and get indices of the physical volume of production. The index-numbers are, however, based mainly on commodities which fluctuate strongly, so that the changes in production are unduly stressed. But a more important defect in the totals is a radical failure to allow for a decline in the quality of the goods and commodities produced, owing to the "persistent endeavour of the authorities to reduce the cost of production and to score quantitative results." (11)

Generally, the use of index-numbers is crude and facile, and it would seem that a more detailed effort to suit the sectional indices to sectional parts of the income is very desirable, and the use of a cost of living index is also worth consideration. The recent official American estimate indicates that it requires an all-inclusive index covering wholesale and retail, and all groups of people, and such an index is not available (79).

22. Conclusion.

Dr. Fellner declared at the Tokio meeting of the International Statistical Institute that "estimation of national income is among the most difficult problems of economic statistics," with often nearly unconquerable difficulties. It seems clear that comparative methodology may do much to assist and suggest in practice, and that the severity of Fellner's own conception of national income makes the complications worse. We need not be as pessimistic as the *Verein für Sozialpolitik* in the conclusion that "attempts at estimating national income are futile." Rather should we take heart at the progress that has been made in principle and theory, in data and practice, over the long period since the International Congress of Statistics discussed the problem at the Hague in 1869.* Great progress has been made in methods, but unfortunately at the same time, the problems have become progressively more complicated, and the demands of social theory and enquiry for precise information much more exacting.

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DISCUSSION ON METHODS OF ESTIMATING NATIONAL INCOME

PROFESSOR VERRIJN-STUART: In his very important paper Sir Josiah Stamp has practically dealt with all questions of method concerning the statistical determination of the national income. It is of course impossible in the brief time at my disposal to elucidate my own opinion of all these questions—unnecessary too, as I agree on many points with Sir Josiah.

I wish to confine myself to a few observations of a more general character. The concept of "income" is in reality of an economic nature, and statistics only come into question when we are concerned with the determination of the actual content of this conception. By the way, for Holland, the latter can only be done by the application of the subjective method, which finds its starting point in the data respecting the assessments in the general State income tax, with a minimum taxation limit of fl. 800.

Now if one wishes to establish economically the conception "income" it is necessary to go back to the fundamentals of the whole economic life. These are found in the fact that man's needs for his maintenance and development are so great and varied that they cannot possibly be fully supplied. Conscious life is the incessant succession of desire and satisfaction. It follows thence that whatever we suppose is indispensable to supply a certain need or to make that supply possible, is of value for man. How great that value is depends upon the importance attached to the need. Income, therefore, is the aggregate of satisfactions which, in a certain space of time—say a year—becomes available after deduction of the sacrifices made for the sake of the realisation thereof.

Whereas human needs, as such alike and comparable, are of the most diversified nature, and their satisfaction is partly connected with, and partly not connected with, the command over material goods, the conception "income" is certainly too narrowly limited if one confines it only to material goods. I endorse in full the objections of Sir Josiah against the material idea of the income concept. The income-concept being determined along the given lines, it is evidently impossible to fix the size of the income. For that purpose it would be necessary to express in a common measure the elements, so entirely different in substance, of which it is formed. Such a measure, however, does not exist. One may undoubtedly compare the value of the enjoyment of some food or refreshment with that of the privilege of personally participating in the commemoration of this illustrious Society, but how can one possibly establish the quantitative whole of the obtained satisfaction of needs even in one single day?

The estimation of the income has a far more limited aim. It takes into account only that part which arises in exchange transactions, as the recompense of services rendered by man, personally, or by the placing of his capital at the disposal of others. The magnitude of the income thus found is, however, much below the reality. For a great part of our needs we provide directly, without any exchange transactions. Sometimes this is taken into account in determining income; for example, the rental value of the house in the owner's occupation is rightly noted in Holland and elsewhere by the fiscal authorities as part of the income of the owner, although—as Sir Josiah has rightly pointed out—one must in this respect go further. If, of two persons with equal money income, the one from his capital furnishes his house himself and the other rents a furnished house, this makes a difference indeed in their money-income, but none in their real income. Apart from this, consider the labour, of extreme importance for our welfare, performed by our housewives. That labour contributes certainly towards the family income, but plays no part in exchange, and payment for it, in the material sense, is not given. That which we regard as personal income—and the same applies of course to the national income as the aggregate of the incomes of the citizens—is thus inevitably *pars pro toto*. The whole is very much greater, but not quantitatively definable. When we limit the income to that part which is derived from exchange transactions, the constituent parts are estimated at their exchange value and expressed in multiples of the money unit which, for this purpose, has hitherto been considered, quite erroneously, as a serviceable standard of measurement.

The foregoing may also, in my opinion, serve in answering the question concerning the distinction between original and derived income, in connection with the possible risk of duplication. If the income is to be regarded as the total of available utility, acquired as a result of operations performed by persons or by capital, no matter whether such occur directly or in exchange transactions (in which latter case it must, of course, in principle be regarded as a matter of indifference whether this exchange takes place within or

beyond the country's frontiers), it follows, I take it, that all income so acquired must be noted as original income, as must also be that derived from the interest of State loans, or from the proceeds of taxation, provided, in the first case, that the loans have been issued for other purposes than covering deficits in the ordinary budget; and in the latter, that the income is the reward for services rendered to the State. The activities of the State have, in the eyes of those who determine their limits, productive value as a means of increasing the utility available to the citizens. The citizens do not therefore begrudge their cost and provide the required sums for the sake of legal security, international safety, or any other object, by payment of taxes or by subscribing to loans, just as they pay out of their income for bread from the baker, or for advice from the doctor. In my opinion, derived income is only that enjoyed by those who receive their subsistence without performing any work—as, for instance, children, so far as they are not already drawing income from their own capital; dole-receiving unemployed, paupers and such like.

Pensions, on the other hand, ought not, as it seems to me, to be deducted in calculating the national income. I regard pensions as postponed wages. The value of the work done by the person entitled to the pension was higher than the amount immediately paid to him. A reserve must therefore be formed by him on whose behalf that work was done, to cover the subsequent pension claim. The full value of the services rendered might have been paid to the worker, leaving it to him, or compelling him, to set aside a part of this income, for example, by means of insurance, for his needs during the years when he will no longer be able to do so by his own labour.

I wish to confine myself to these few brief remarks and close, on my part too, with a word of sincere homage for the address of Sir Josiah, with which the second centenary of the Royal Statistical Society has been ushered in in such a happy way.

PROFESSOR FRANÇOIS SIMIAND: After the exposition we have just heard, full as it is of facts and ideas, of science and experience, I should have liked, as, no doubt, would many of my colleagues, to raise certain questions and offer certain comments on various special points; but the time at our disposal does not permit of any such detailed examination, nor, perhaps, is this the proper occasion for it. I therefore desire to make use of the opportunity with which I have been honoured, solely and supremely in order to associate myself with the act of faith with which Sir Josiah Stamp concluded his paper, namely, of faith in the ability of statistical science to deal with the material under discussion and to bring about increasingly reliable results. In so associating myself, I am bold enough to extend this faith in statistics to their application in three separate directions, in which it seems to me that both the requirements and the possible results may now be considered to justify this ambition.

The first point I should wish to make would be that beside the

estimation of the national income, and perhaps even before it, economic statisticians should aim at an estimation of the national wealth; just as families and individuals are accustomed to take both their income and capital wealth into consideration. The sources and the fundamental nature of wealth alike provide reasons for doing this, and if the two problems are attacked simultaneously it will be easier to deal with some of the doubtful items which have just been the subject of discussion.

My second point would be that in considering "national wealth," a term commonly covering both income and capital wealth, we should gain by clearly distinguishing and separately treating two very different but equally important conceptions: namely, the aggregate wealth in private hands and the total wealth of the nation considered as a whole. In this way we should be able to avoid, or at all events to diminish, many difficulties, and to escape a good deal of controversy (notably, for instance, on the method of treating the interest on Government debt, etc.), and at the same time our knowledge—our grasp of the realities, especially with regard to the evolution from pre-war to post-war conditions, would be usefully enlarged.

Yet, as the time is short, I will say no more now on these two points, because I can refer to the model scheme for the computation of these four things (income, wealth, aggregate in private hands, and collective total) used by Monsieur Colson in making the estimates for France, which, thanks to the long duration of his scientific activities, he has achieved three times in a period of thirty years. And note that this is for France; that is to say, for a country with no general income-tax suitable for the purpose and possessing no recent census of production; such conditions, therefore, involving as they do a greater number of special difficulties, and therefore requiring more special solutions, are in themselves of methodological interest.

My third point I should like to emphasize rather more strongly. I would ask you to consider whether in this particular subject, as, or perhaps even more than, in any other in the economic field, it would not be appropriate and very instructive to rely on an accepted principle of method of which I think the value will become more and more recognized: namely, that relative data are often more certain and more significant than absolute ones, and that many of the most important problems in economics can be better formulated and better treated in terms of relative change than in terms of absolute situation. It is certainly both useful and interesting to have as accurate an estimate as possible of the wealth of a country at a given date; but is it not still more important, in many respects, to know if, during a given period, this wealth has increased or diminished, and, if so, in what proportion and with what special features, or whether it has remained stationary? I myself believe that it is. I hold this view strongly, as the result of experience, and on several different grounds.

First of all, in this way we should be able to get rid of a number of minor difficulties. If the sheep-shearer's income is a positive

income because it corresponds to a certain increase in the value of a certain trade commodity, does the barber's income correspond to an increase in the economic value of a man because he is better shaven, or is it merely a derivative income? Such a question has been and still is a source of confusion in many discussions of this subject, as is likewise the question of the fees of doctors and lawyers and the salaries of judges and professors. Look at the relative importance of these sums in the national total; it is not sufficiently large for the amount to be greatly affected whichever method is chosen; but in any case, if we adopt the same solution in all our comparative estimates the element of uncertainty will disappear, provided that we can reasonably presume that the proportion of such income to the total has not materially changed during the period under examination.

The second and more important consideration is that by the relative method we should obtain, and obtain for the major components of the problem, results which would be better, more numerous or more continuous, more certain and more significant. To begin with, if it is true that in the complete estimates we now possess we can distinguish certain large categories of wealth which constitute by far the largest portion of the total, we shall—since the data relating to these categories are usually more ample and more continuous retrospectively than the rest—be able to derive from them a relative index of the probable aggregate variation, even without having at disposal repeated complete calculations. Then, above all, do not let us forget that even these computations, the best we have, are not entirely based on facts actually registered, but include some central element depending on either estimates or declaration which may possibly be biased; so that the absolute value of the result must be regarded with some hesitation, or even with doubt. But if we use these totals for the purpose of making comparisons at different periods, then, provided we know the conditions of the estimates and the trustworthiness of the declaration to be fairly constant throughout, or, at least, may assume them to be so, we shall be able to determine the amount of variation, which will not be affected by the doubtful elements referred to above.

A third and no less important consideration is that with a relative treatment we shall be able to make a better estimate of the concomitant and even of the interpretative factors of the problem. I will only mention one here. It has sometimes been attempted to include in the conception of the wealth of a nation the value of the individuals composing it. That idea has now been generally abandoned, and it is doubtless more accurate to regard this as an explanatory, rather than a constituent, factor of wealth. But in any case, how can it possibly be expressed in figures? Let us observe that it is not customary for the balance sheet of a business to include under any head the value of the captain of industry who directs the undertaking, although his contribution is a decisive one; but does it not appear in the comparative figures of successive balance-sheets, which indicate whether the business is prospering,

standing still, or declining? In the same way, will not the movement of a country's wealth—due account being taken of the other factors to be considered—enable us far better to disclose what may have been the possible or probable part of the economic behaviour of the people composing the nation, according to their character, tendencies, and the development of those qualities, than would any static attempt to arrive at such a result?

Finally, even for a comparison between nations, a comparison between movements of wealth will give results of greater certainty and significance than a comparison between the absolute amounts. As regards absolute figures of income or of wealth, many of the examples we have had before us show how greatly this species of calculation is affected by the differing conditions of different countries; first, owing to the nature of the sources (which is itself conditioned, particularly, by the nature and the basis of the taxation, the nature and time interval of enquiries, etc.), and, further, by the nature of the national economy itself, the direction and character of the nation's activities (for example, the very characteristic difference already referred to between the American and English theory and practice with respect to profits on the purchase and sale of real and personal property). How can a comparison of absolute totals derived from such discrepant material have any real meaning? On the other hand, if we can obtain a picture of the movement, during a given period, of national income or of national wealth in each of the different countries, compiled in accordance with their respective conditions of assessment and compilation and of economic constitution and practice, will not these movements permit of a comparison which, since each element is constituted in a respectively similar manner throughout the period, will give more useful and interesting results? Moreover, if the comparison of the wealth and income of various nations is of primary interest at the present time, as is shown by the efforts made to arrive at such a comparison, is it not even more important to discover if and in what manner the wealth or income has varied between the pre-war and post-war periods: whether, and if so why, there has been an increase in the case of some nations and a decrease in that of others and whether, and if so why, the situation of some has remained relatively unaltered?

It is towards these ends that I believe the study could profitably be directed and developed, starting from the remarkable results already achieved by the efforts for which we must all feel grateful and recognize as both legitimate and meritorious. This gratitude should be especially felt and emphasized here and now; for would it not be scandalous, in the land where the illustrious work of Adam Smith held up the *Wealth of Nations* as the central aim of economic study, if statistical science, so nobly represented in this centenary Society to-day, should abandon this aim as impossible of attainment? But it is also to Adam Smith that we should turn for the justification of the importance assigned and the efforts applied to the study, to use his own phrase, of the "progress of opulence in different nations" and of that of "the advancing, stationary, or declining state" of their national economy. It is thus under his

protection that I would end these short remarks and in his name that I hope to deserve at least your indulgence.

MR. A. W. FLUX: The two procedures in estimating National Income, referred to by Sir Josiah Stamp in his remarkably lucid and penetrating address, in my admiration of which I yield nothing to those who followed him, are very closely related. That adopted by himself and Dr. Bowley, following Dudley Baxter and Sir Robert Giffen, is an evaluation of the payments made for the services of the factors of production,—the other, defined in his citation from Marshall, is an estimate of the value of the goods and immaterial services produced. The value of the productive services must be the reflection of the value of the goods and direct services produced, or at any rate of their anticipated value. In the long run factors of production cannot receive more—or less—than the value of these goods and services, which are, in fact, their reward. In any one year they may receive either more or less than the products of that year, and it may be that this is one of the points at which divergence of results between the two methods arises.

When in 1912 my colleague, Mr. Macrosty, and I, coming into possession, for the first time in history, of a complete survey of mineral, agricultural and industrial production in the United Kingdom, proceeded to the realization of Marshall's definition, we had in view various advantages of that procedure. It afforded the opportunity of knowing the make up of the National Income—how much consisted of food, how much of clothing, of shelter etc., what is taken in the shape of additions to capital equipment. Incidentally, it directed attention to the comparative importance of direct services not embodied in material goods. The limitation contemplated by Prof. Fellner and those who think with him is, as I look at the matter, neither reasonable nor consistent. Sir Josiah Stamp has dealt sufficiently with this, but I would like to make reference to one point connected with it. Transportation is dealt with by Prof. Fellner as furnishing a series of services, the proceeds of which he accepts as forming part of the National Income. I find it very hard to admit that the service of transportation, whether of goods or of persons, is a part of the National Income, while the enjoyment derived from listening to fine music, the instruction received verbally from University Professors, or the services of broadcasting to those who cannot come into personal contact with their teachers, is declared to be no addition to National Income, the payments received for such services being described as "derivative" income. The conception appears to me, as a scientific conception, to be entirely out of date. All our incomes consist of satisfactions, and whether material goods intervene in one way or in another in the process of receiving these satisfactions, it is a fatal error to cling to the materialistic basis of theories discarded long since by thinkers rightly acclaimed as leaders.

Naturally, the intrusion of a new procedure into our national calculations of income evoked some involuntary reactions from those who had advocated the method of evaluating payments to

producers instead of the values of things produced. What could statisticians at the Board of Trade know about such abstruse things as income? It became necessary to put such upstarts in their place. Happily Sir Josiah has shown us to-day with admirable clearness that both methods have something to contribute to the study of the National Income.

Various grounds have been put forward for distrusting a procedure that allowed estimates proceeding from the financial side to be challenged. We were told that our contribution was essentially a subordinate one at the best, and many criticisms were directed against details of procedure. I venture to assert that the more serious of the criticisms were, in effect, cited from the Report itself in which the first British estimate on the new basis appeared. They have been taken up and repeated by others who had not a direct acquaintance with that Report, and imagined them to be new and destructive criticism of this method of procedure.

An outstanding challenge is the assertion that, in the application of this procedure, too great a share was given to estimates as against ascertained data. Dr. Bowley may have overlooked, in voicing this point of view, that it is not only the values resulting from industrial processes that form an ascertained element, but that the values of the materials worked on are also ascertained. These are, in the case of the United Kingdom, mainly derived from imports, so far as the Census of Production did not provide direct data. It is true that the imports were broken up, on a basis of the exercise of personal judgment (which perhaps some might prefer to call "guessing"), between those subsequently subjected to processes of elaboration and those directly passed on through distributing agencies to consumers. The room for uncertainty lies, not in the total value, but in the margin between goods carrying both manufacturing and distributing charges and those carrying the latter only. The total of the values added in manufacture was not affected by possible error in the division, but only the difference between materials at the place of importation and the same materials at factories or works. If this is taken into account, it will be seen that the ascertained data form, as against the estimated data, no less important a proportion in the procedure introduced, in 1912 than in that dating from an earlier period.

As an illustration, the figure representing wages in Dr. Bowley's procedure rests on a relatively narrow basis of ascertained fact, elaborated by a correspondingly large amount of estimate, when compared with the estimate of materials worked up that is used in the calculation based on the Census of Production. The direct services element in the latter estimate, partly based on data derived from Income Tax statistics, may claim equal consideration with much that is treated as ascertained fact in the other procedure, being derived from essentially the same sources.

I will not enter to-day into further particulars of the matters to which I have referred, but I will venture to claim that the conception defined by Marshall, but not realizable in the United Kingdom until a comparatively recent date, is more fundamental than that

which served through most of his life as the only available foundation for estimates of British National Income.

PROFESSOR CORRADO GINI: All those who are dealing with the important problem of estimates of National Income must be grateful to Sir Josiah Stamp for the exposition of methods and principles he has given us in this paper. When the terms of a problem are clearly defined and well set out it is half-way to solution. I think that Sir Josiah's paper has brought us some steps forward on this road and may well lead to further advances.

I hold the view that in the case of national income, as in that of national wealth, a distinction may usefully be drawn between *private income*, represented by the total of individual incomes plus the undistributed income of privately owned collective bodies, and *public income*, represented by such part of the income of public bodies as has not already been included under the head of private income. *Public income* may either be active (as in the case of income from crown property, which does not increase private income) or passive (as when the State has incurred a foreign debt, the interest on which is paid out of taxes levied on private incomes), but as a rule it does not represent an important part of the national income.

If the problem is set out in this way, we at once get rid of the difficulty, referred to by Sir Josiah Stamp, of the high remuneration paid for certain professional services. Since such payments figure in the personal income of the leading barrister, the prima donna, or the celebrated physician, it is obvious that they ought to be included as such in the private category of the national income. Services apparently similar, although often really very different, will show much lower sums in the incomes of lawyers, singers, or doctors of the second rank. It does not seem to me that there would be any theoretical advantage, and it would certainly involve practical difficulties, if we were to substitute a general average for the prices actually paid in single instances. At all events, it is clear that such substitution could not properly be applied to the more highly paid services only.

Also the difficulty envisaged by Professor Wesley Mitchell and Dr. Kuznets, in the paper they presented to the International Institute of Statistics on estimates of national incomes of mutilated States, will be greatly diminished even if it does not entirely disappear. According to the suggested method, the private income of Austria or Hungary will consist of the aggregate private incomes of Austrian and Hungarian citizens. The difficulty, if difficulty there be, of evaluating the national income, is thus confined to the portion represented by public income, which is generally of minor importance.

On the question of duplication to which taxation may give rise, all, or almost all, Sir Josiah's arguments appear to me to be sound when taken singly, but to tend as a whole towards solutions which are not very clear from the theoretical standpoint and which, if I am not mistaken, would in practice lead to complications. The

method advocated in my own report, presented to the International Institute of Statistics, appears to me to solve the problem in a manner better suited to the ends in view.

In my opinion, the essential distinction is between (1) taxes whose yield increases individual incomes, either through direct payments or through public works which increase the income obtained from private property and (2) taxes whose yield is assigned by public bodies to remunerate personal services rendered to the people, such as sanitation, public safety, civic improvements and amenities of various descriptions. The former should be regarded as expenses incurred in the production of personal income and be deducted therefrom, whereas the latter should be treated as distributions of income and should not be deducted. I believe that it is not impossible to distinguish in practice between these two categories of tax-yield, although, of course, only approximately. With respect to the interest on the national debt, it appears to me logical to compute it in the private income of the nation, just as it is computed in individual incomes, and to deduct therefrom the amounts paid in taxation out of which the interest is provided.

Sir Josiah, in the early part of his paper, justly refers to the influence which the available statistics exercise on the notion of income itself; their influence on the methods used in its estimation is naturally still greater. Having had occasion to estimate the national income of about twenty countries, I may confess that it was not practicable to apply the same procedure in any two cases. It is not therefore possible in my view to speak of good or bad methods in a general sense, but only of methods good or bad in relation to the available statistical material. Nor do I see any reason for reproaching the writers who, unable to do better, have calculated the wealth of some countries on the basis of the multiplier method or of typical budgets of a number of families. We cannot assume that the Esquimaux build themselves houses with double windows and central heating.

In estimating national income, whatever be the procedure adopted, we shall have to add together many separate items, and this can only be done on the basis of a common denominator which must be founded, either directly or indirectly, on exchange values. Here we may find the reason why many services are not, and in the past still more were not, included in income, while other services are so included. The rent of a house is so included because there is a market for rental values. The hire of furniture is not included because it is exceptional for furniture to be hired. If the hiring of furniture were to become frequent the hire value would certainly be included in practice, as it should be in theory, in the calculation of national income. The increasing extent of the employment of women outside the home and the consequent replacing of their unpaid domestic labour by paid services explains the possibility and justifies the increasing practice of including the domestic service of members of the family in the estimate of national income. This, as I indicated in my report, leads to difficulties when an attempt is made to compare the amount of the national income at different

periods; but the desire for comparability ought not to be pushed to the point of hindering a methodological advance which can fill the gaps implicit in previous estimates.

One effect of the influence of conditions peculiar to the different countries on the methods of estimation appears to me to be reflected in the difference between the systems adopted by English and American writers in dealing with capital increments. From the theoretical standpoint it is necessary in my view to distinguish between increases (or decreases) which are accidental and those which are of a systematic character. These last may be, and normally are, foreseen, and should be reckoned by statisticians, as they are by the persons materially affected, in the same way as income from other sources. A farmer is prepared to acquire a piece of land, the returns from which he estimates at the rate of, say, 3 per cent. per annum, because he anticipates, besides this return on the capital invested, an annual increase in the value of the land of, say one-half per cent., and the purchaser of vacant building lots may relinquish the idea of receiving any profit on the land itself and rely on an increase in the value of the land as the sole return on his invested capital. In so far as they can be forecast, systematic increases in capital value are included for the major part in the incomes of speculators, which are computed in the total of private income. I do not see, on the contrary, on what grounds it is possible to include accidental and therefore unforeseeable increases of capital value in the national income. (It is true that because of their accidental nature, their inclusion would not affect the general movement of the national income, but would merely cause irregular fluctuations.) In America, a new country with a greatly increasing population and rapidly growing urban centres, and one where new lands were continuously brought into cultivation, much more importance, at all events in the past, had to be attributed to systematic increases in capital value than in countries with an old and, in some respects, stationary economic constitution, like England. For this reason it is natural that American writers should favour the inclusion of capital increment in the national income, while English writers are adverse to it.

I was at first somewhat surprised to learn that Sir Josiah believes that as civilization progresses the portion of the income representing personal services increases. As regards modern times, I had the opposite impression, which I expressed in my report. My impression was based partly upon the increasing mechanization, characteristic of modern civilization, partly on the consideration of the very different relative importance of domestic services in the more modern as compared to the less modern countries. A middle-class family which in Europe would have two or three servants, would have one at most in America, and ten or a dozen in India. It is possible, however, that in other parts of the field other factors come into play which balance or more than balance these, and that when everything is taken into consideration the truth rests with Sir Josiah rather than with myself. Encouragement of an enquiry into this point may be one of the profitable

results of a paper, on which I have great pleasure in offering Sir Josiah my most cordial congratulations.

SIR JOSIAH STAMP, who was unable to reply at the meeting, for lack of time, afterwards sent a written comment as follows :—

I agree with Professor Verriijn-Stuart in treating pensions as postponed wages, but that is not inconsistent with any limitation to current services. Strictly, the money incomes of civil servants now serving should be supplemented by the sums now owed to them to provide future pensions, for that is their full remuneration. In practice we take the money wages of the present servants and the money pensions of their predecessors as roughly equivalent. But the effect is as if we gave full value for present services and nothing for past or vanished services. In the case of war pensions there are no present services to be evaluated, and nothing on which to hang the pensions for past services in an analogous manner. But the test I apply, that a double burden paid through taxes because of a longer war cannot signify a richer nation, is a sufficient one for me. As Professor Simiand says, it is very helpful to construct correlative estimates of national wealth, as they present difficult problems from a different angle, though I think he goes too far in suggesting that we can escape controversy on the Government debt. That problem remains rather more disputable in its capital form, as I have shown in my recent estimate for Great Britain.

It is also true that comparisons of movements are more independent of error than absolute comparisons, but only if we have solved the comparative price problem. They may not be movements at all when we have eliminated price change, and this elimination requires much study. Professor Gini's distinction between the classes of taxation, according to their contribution to production, reminds one of the old controversies on onerous and beneficial taxes, and it would be excellent if one could actually make it, but at most tests it becomes quite indeterminate.

For the rest, it is satisfactory to find so large a measure of agreement, ready for the next advance.

THE CENTENARY OF THE ROYAL STATISTICAL SOCIETY.

PREPARATIONS for the celebration of the completion of the first hundred years of the Society's existence were begun in 1932 with the issue of a circular to Fellows inviting them to make donations or give guarantees towards the necessary expenses. The response was satisfactory, and the Council then resolved to invite the International Statistical Institute, which had not met in London since 1905, to hold their ordinary (and Jubilee) meeting in the Centenary week as guests of the Society, and this invitation was accepted. It was also ascertained that the Honorary President, the Prince of Wales, hoped to be able to take some part in the proceedings and that the third week in April, 1934, would probably be convenient to him. The Council, therefore, approached the Foreign Office and the Dominions Office with the request that, as on the occasion of the Jubilee of the Society, His Majesty's representatives abroad might inform the Governments of the respective countries to which they were accredited of the meetings of the Society and Institute, and invite them to give facilities for the attendance of official, academic, and other statisticians. This request was granted. Representations were then made to the Lords Commissioners of the Treasury that, in view of the international character of the occasion and of the close connexion that had always existed between the Public Departments and the Society, His Majesty's Government might favourably consider an application for a grant towards defraying the expenses. After negotiations, in which the Board of Trade took part, the Treasury agreed to make a grant of £700. It may be added that among other contributions were £100 from the Royal Economic Society, £50 from the Bank of England, and 50 guineas from Barclays Bank. As the International Statistical Institute was able to provide for its own printing out of a special fund it appeared probable that all financial liabilities could be met.

Instead of appointing a large Reception Committee as at the time of the Jubilee, the Council entrusted the Executive Committee with the duty of making all arrangements for the Centenary Celebrations and appointed Major P. Granville Edge, O.B.E., as a special secretary for the detail work; it may at once be said that the subsequent success was very largely due to his organizing ability and great faculty for taking pains. In order to co-ordinate the celebrations held by the Society with the domestic activities of the International Institute, another Committee was set up, consisting of the President and Executive of the Society and those Fellows of the Society who

were also members of the Institute. Later, a Ladies' Committee, consisting of Lady Stamp (Chairman), Mrs. Bowley, Miss Collet, Mrs. Edge, Miss Etlinger, Mrs. Greenwood, Mrs. Heron, Mrs. Leak, Mrs. Macrosty, and Miss Thorburn (Secretary), was nominated to arrange for the entertainment of the lady visitors who accompanied the members of the International Institute.

The Chancellor of the University of London, the Right Honourable the Earl of Athlone, K.G., P.C., G.C.B., very kindly promised to open the Session of the International Institute, and the authorities of University College placed their rooms at the disposal of the Society and the Institute. Gradually, with the help of prominent Fellows of the Society the programme of entertainments was built up. Arrangements for the travel and accommodation of the overseas visitors were made through Messrs. Thos. Cook and Sons.

The Centenary week began on 16 April with a function special to the Institute, although the President and Council of the Society were officially present. The Chancellor of the University of London welcomed the members of the Institute and other overseas delegates, and afterwards Lord Meston, our President, extended to them the hospitality of the Society. These proceedings and the subsequent activities of the Institute during the week are reported elsewhere (see pp. 473-77). It may be noted that Major Edge was able to arrange, with the consent of the College Authorities, an exhibition of calculating machines in the Cloisters of University College. In the evening Sir Austen Chamberlain, K.C., M.P., Miss Diane Chamberlain, and the Court of Governors held a reception at the London School of Hygiene and Tropical Medicine. A feature was the exhibition of some interesting cinema films.

The Centenary Meeting proper was held in the large hall of University College at 3 p.m. on 17 April. The Honorary President of the Society, His Royal Highness the Prince of Wales, took the Chair and delivered the following address:—

"I am very glad to be here in the capacity of Honorary President of the Royal Statistical Society, to inaugurate our Centenary Celebrations and to welcome our guests, the members of the International Statistical Institute, which, founded at the time of our Jubilee celebrations, now completes fifty years of useful activity.

"Twenty-nine years ago, my Father welcomed, as I am welcoming, a numerous company of distinguished statisticians from all parts of the world. He spoke with pride of the advances which had been made in statistical knowledge, in the making of which both the Royal Statistical Society and the International Statistical Institute had played important parts, and expressed confidence that the session which he was inaugurating would 'neither in fertility nor solidity of results, in any degree fall behind its predecessors.'

“Forty-five years earlier, my great-Grandfather, the Prince Consort, had welcomed the members of the first International Congress of this kind to be held in London, and his opening address was inspired by the same belief in the social importance of statistical investigations. In those days statisticians did not command as much public respect as they do now, and most people regarded all statistics as incredibly dull. Prince Albert, himself an accomplished statistician, and speaking in the presence of his own teacher, the illustrious Quetelet, powerfully defended his colleagues against these charges. In 1934, we need not indeed defend statistics against the charge that their study is ‘dry and unpalatable.’ Important truths are often dry and sometimes they are extremely unpalatable. I know of no more important truths than the deductions from social experience of those lessons by which the community should profit.

“When the Royal Statistical Society was founded one hundred years ago as the Statistical Society of London, the information collected by the Government of this country was scanty, and the Society devoted its earliest efforts to ascertaining the truth about the condition of the people. Inquiries into the state of the inhabitants of various districts of London, their occupations, their education, their social condition, were set on foot, thus anticipating some of the great work of Charles Booth, which is now being repeated. The facts disclosed by these inquiries undoubtedly had much influence on the Governments of the day, and, with an awakening of the public conscience, government activity in this field increased, so that the Society was able to leave in the hands of public departments tasks beyond the scope of a private organization. The critical examination and improvement of existing statistics, the extensions of the ‘numerical method’ to new branches of science, the introduction of new methods of mathematical analysis bringing to light essential truths hidden in masses of data, such have been the tasks of this and all other Statistical Societies in modern times. Our Society no longer conducts inquiries, but is a testing house to which Fellows bring the results of their work and submit them to the criticism of their colleagues. The great English statistician, William Farr, nearly sixty years ago began an official report with these words:—‘How the people of England live is one of the most important questions that can be considered; and how—of what causes and at what ages—they die, is scarcely of less account: for it is the complement of the primary question teaching men how to live a longer, healthier, and happier life.’

“As you know, I am very keenly interested in these problems which concern the ability to live a healthy and happy life, and particularly in the difficulties which, unfortunately, prevent at present numbers of our fellow countrymen from attaining that end. I am glad to know that, throughout its long career, the Royal Statistical Society has always occupied itself with the living questions of the day—with the condition of the people, their health, their occupations, their production, their trade, their moral state—and, by providing accurate compilations and analyses of the numerical facts, has taken its share in rousing public opinion and in stimulating

statesmen to seek remedies for social diseases. The cure of obvious evils depends first on the ascertainment of facts, and secondly on the free interchange of opinions in gatherings such as this. Since Farr's day the data for answering both his questions have improved out of all knowledge, not only in this but in most civilized countries. In most countries, especially during the last twenty-five years, schemes for social improvement have multiplied, and statistical records of the results are available for future guidance.

"The statesmen and scientists whom Prince Albert addressed still inspire us through their writings, and many of those whom my Father addressed still inspire us by their living example. I am confident that this distinguished audience will enlarge still further the bounds of statistical knowledge and, by making accessible to the statesman, the administrator, and the philanthropist the teaching of collective experience, will play their part in promoting the happiness of all mankind."

The Right Honourable the Lord Meston of Agra and Dunottar, President of the Royal Statistical Society, and Professor Zahn, President of the International Statistical Institute, thanked His Royal Highness in brief speeches and the Prince then withdrew. Lord Meston then took the chair and Sir Josiah Stamp, G.B.E., read a paper on "Methods used in Different Countries for Estimating National Income," and Professor Verriijn-Stuart, Professor Simiand, Mr. (now Sir) A. W. Flux, and Professor Gini took part in the discussion that followed; further debate was postponed to the ordinary meeting of the Society in May. The several speeches are reported on pages 423-66.

The Centenary banquet was held at the Savoy Hotel in the evening of 17 April and 262 persons sat down to table. Among the guests of the Society, apart from the members of the International Statistical Institute, were the Brazilian, Spanish, and Polish Ambassadors, the Finnish Minister, the Consul of the Danish Legation, the High Commissioner for the Irish Free State, the Presidents of the Royal Society, the Institute of Actuaries, and the Statistical and Social Inquiry Society of Ireland, the Principal of the University of London, the Chairman of the London County Council (Lord Snell), the General Manager of the Port of London Authority, the Secretary of the Board of Trade, the Under Secretary of State, Dominions Office, the Secretary of the Ministry of Agriculture and Fisheries, the Secretary of the Ministry of Health, the Secretary of the Ministry of Labour, the Secretary of the Medical Research Council, and the Chairman of the National Provincial Bank. Mr. A. L. Arnold, the Vice-President of the Manchester Statistical Society, also attended in place of the President, the Earl of Crawford and Balcarres, who had to decline on account of illness. After the loyal toasts were

honoured, Sir F. Gowland Hopkins, President of the Royal Society, proposed the toast of "The Royal Statistical Society," and Lord Meston responded. Sir Herbert Samuel, Past-President, then proposed "The International Statistical Institute," to which Professor Dr. F. Zahn replied. Finally, Sir Josiah Stamp, Past-President, toasted "The Guests," and the Right Honourable the Lord Snell, Chairman of the London County Council, replied.

On the following evening, 18 April, at 10 p.m., the Government held a reception at Lancaster House and the Right Hon. Walter Runciman, M.P., President of the Board of Trade, and Miss Runciman received the Fellows of the Society and members of the Institute.

On the evening of 19 April, The Corporation of the City of London entertained the Society and the International Statistical Institute in a manner worthy of the City's splendid traditions of hospitality. The guests were received by the Rt. Hon. the Lord Mayor and Sheriffs, and there was an exhibition of the City's plate, of its ancient charters and manuscripts, and of such objects of particular interest to statisticians as the first edition of John Graunt's "Natural and Political Observations etc." A concert and a dance also formed part of this function, which will long be remembered by those who were present, and our foreign visitors will take home with them a vivid impression of the magnificence of civic hospitality in the ancient City of London.

In the afternoon of Friday, 20 April, the Royal Economic Society entertained a number of members of the Institute and Fellows to tea at the London School of Economics and Political Science, and thereafter to an address by Professor Cannan on "The Future of Gold in Relation to Demand." Lastly, to conclude a crowded week, the Society invited Fellows and guests to a ballet in the evening at Sadler's Wells Theatre, at which Tschaikovsky's "Casse-Noisette Suite" and Vaughan-Williams's "Job" were presented.

While the members of the Institute were engaged at their meetings, the Ladies' Committee, with the assistance of Major Edge, were active in providing occupation and entertainment for the lady visitors. The Committee of the London and National Society for Women's Service invited the lady visitors to become Honorary Members of the Society for the time being and to make use of Women's Service House. On the Monday afternoon, after a visit to Westminster Abbey and the Tate Gallery, the Ladies' Committee entertained them to tea at Women's Service House to meet members of the National Council of Women. Lady Stamp and Miss Ishbel MacDonald received the guests and Miss MacDonald was also good enough to address the gathering. On Tuesday afternoon the visitors attended the Prince of Wales's meeting and in the evening they were entertained to dinner by the Society at the Cumberland Hotel under

the presidency of Lady Stamp, who made a brief speech; Miss Willcox (Cornell), Frau Präsident Zahn, and Mrs. Heron also spoke. After a visit to Downe House on Thursday afternoon most of the ladies went to tea with Sir Josiah and Lady Stamp at their house at Shortlands, and on Friday afternoon Lady Steel-Maitland had another tea-party at Cadogan Square. During the daytime there were excursions to Stoke Poges, Windsor Castle, and Hampton Court (where the Superintendent very kindly admitted the ladies, though it was after hours), a tour on the Port of London Authority's launch round the Port of London, and visits to the Royal Horticultural Society's Show, to Broadcasting House, to the British Museum, and to the workmen's flats erected by the St. Pancras Improvement Society. The thanks of the Society are due to the Authority and to the other bodies who contributed to making these excursions so great a success. The several parties of visitors were accompanied on these trips by members of the Ladies' Committee and other helpers, to whom, and especially to Mrs. Bowley, the Society is greatly indebted for the energy and enthusiasm which they put into their voluntary duties.

The Council at an early stage of their deliberations decided that some account of the activities of the Society during the past hundred years should be compiled. Dr. Bonar undertook the task but was only able to complete the introductory part, and the work was then taken over by Mr. Macrosty. It had been hoped that the book would be ready for presentation to Fellows and their guests during the Centenary week, but various causes brought about a disappointment of our expectations, and copies were not distributed till some time in May. Specially-bound copies of the "Annals of the Royal Statistical Society" were presented to His Majesty the King, His Royal Highness the Prince of Wales, the Earl of Athlone, the Prime Minister, the President of the Board of Trade, Sir Austen Chamberlain, the Lord Mayor, and Lord Meston.

Messages and addresses of congratulations have been received from the following bodies :—

- The American Statistical Association.
- The Dominion Bureau of Statistics, Canada.
- The Society of Polish Economists and Statisticians.
- The Census and Statistics Office, South Africa.
- The British Association for the Advancement of Science.
- Die Deutsche Statistische Gesellschaft.
- La Société de Statistique de Paris.
- La Société Hongroise de Statistique.
- The Economic Society of South Africa.
- The Swedish Statistical Society.
- The Swiss Statistical Society.

THE TWENTY-SECOND SESSION OF THE INTERNATIONAL INSTITUTE
OF STATISTICS.

By A. L. BOWLEY, Sc.D., F.B.A. .

ON the invitation of the Royal Statistical Society, the XXIInd Session of the International Institute of Statistics was held in London in April (16 to 20). It was attended by about 80 members, 11 delegates of Governments (other than members), and about 17 guests; in all some 24 countries were represented.

By the courtesy of the University and of University College the meetings took place in the Hall and rooms of University College. The members were welcomed on Monday morning, April 16, by the Earl of Athlone, in his capacity of Chancellor of the University, in the following speech:—

It gives me great pleasure to welcome you, on behalf of the University of London, in this, the oldest of the schools of our University. There is indeed a peculiar fitness in the choice of your meeting-place. You are as a corporate body already of mature growth and, in the fifty years of your existence, you have accomplished much. Your spiritual parents, the Royal Statistical Society, rejoice with you in the success you have achieved, and their representatives are present to-day to take part in your scientific work, but this College recalls memories of your parents' parents.

In 1860 an International Statistical Congress met for the first time in London, and among the names of members of its committees one reads those of Sharpey and de Morgan, names to conjure with within the walls of this College. The President of the Section on Statistical Methods was Monsieur Adolphe Quetelet, and although that name has no direct associations with this College, the indirect influence of Quetelet on its statistical future has been great, for Quetelet influenced the thought of Francis Galton, and to that great pioneer of statistical science in England the College and the University are overwhelmingly indebted. I shall not attempt to summarize that touching and inspiring account of the relations between Francis Galton, W. F. R. Weldon, and Karl Pearson which we owe to Professor Karl Pearson, but I may be permitted to remind you that to that association we owe the existence here of a department of teaching and research which through more than forty years has attracted students from every part of the world and made the names of Galton, Weldon, and Pearson household words wherever statistical and biometric researches are pursued.

Our University indeed can be proud of its statisticians. In this College is placed the Galton Laboratory, where Professor R. A. Fisher, Dr. Egon Pearson, and their colleagues continue the work

begun by Francis Galton and Karl Pearson. A few minutes' walk brings us to another school of the University, the London School of Economics and Political Science, where your honorary treasurer, Professor A. L. Bowley, has for many years played an honourable part, enlarging the bounds of knowledge by his researches and sending into the world young men and women well equipped to apply the statistical method in a variety of fields of human activity. Still nearer, the youngest of our schools, the London School of Hygiene and Tropical Medicine, has begun to train medical post-graduates in the applications of the statistical method to their problems.

In comparison with her sisters of Oxford and Cambridge, this University is very young, but she has displayed her sympathy with your pursuits in a very practical way, and among her graduates and undergraduates are many who will follow your proceedings with intelligent interest. Of the present Council of the Royal Statistical Society nearly half, including the three honorary secretaries, are either graduates, teachers, or past teachers of the University of London.

On behalf of the University of London I bid you very heartily welcome and trust that your visit to us will be as great a pleasure to you as it is to us to see you here.

Lord Meston later made a brief speech of welcome in the name of the Royal Statistical Society, and Dr. Zahn, the President of the Institute, responded in both cases.

As usual, three Sections were formed for the reception of Reports and the reading of papers, and they held meetings on Monday afternoon and Tuesday and Wednesday mornings. The Sections reported to Séances Plénières which took place on Thursday afternoon and Friday morning. Some account of these is given below.

Apart from the statistical work of the Session there was very important private business to transact, to which Wednesday afternoon and Thursday morning were devoted. At the Session at Rome in 1925 a discussion began on the question of the appropriateness of the constitution of the Institute for its functions, and more generally on what these functions were in relation to the work of the League of Nations and in the changed circumstances of the post-war world. These discussions dragged on in an inconclusive way in subsequent Sessions and hindered the work of the Institute. The whole matter was settled at these meetings in London. It was found that there was no clear desire for any radical change, and that with slight adjustments of the Statutes the Institute would be free to adapt itself to modern requirements and to develop by meetings, committees, and publications in any way which promised to be useful. The establishment of the quarterly *Revue de l'Institut International de Statistique*, which was due to the earlier discussions, had gone far to meet the wants which had been expressed. In London the Statutes were

revised in detailed wording rather than in essence. In fact the principal change was to increase the membership of the Bureau by one more Vice-President, so as to make it more representative and allow of more frequent changes. Great relief was felt when at the end of a protracted meeting on the Thursday morning the President was able to announce that the whole question was finally and harmoniously settled.

Since the London meeting followed so quickly after the Extraordinary Session in Mexico of last October, not many of the thirty or more Commissions of Investigation had been able to present reports, and of those presented some were only provisional. A complete list of the papers and reports read or received is given below. In spite of the shortness of the time allotted to sectional work several good discussions took place. In particular the groups of communications and reports relating to National Income and to Industrial Fluctuations excited much interest and are likely to result in further useful work on these subjects.

The officers were elected as follows :—President, Zahn; Vice-Presidents, Willcox, Huber, Julin, Savorgnan; Treasurer, Bowley; Secretary-General, Methorst.

On the invitation of the Greek Government it was decided to hold the next Session at Athens in the year 1936.

Since the Jubilee of the Institute was celebrated at this meeting, the President had prepared a very interesting and complete history entitled “50 Années de l’Institut International de Statistique,” which was circulated to members and visitors and of which a copy was graciously accepted by the Prince of Wales.

In addition to their own business meetings those attending the Session took part, as guests of the Royal Statistical Society, in the meetings and entertainments arranged by that Society in celebration of its Centenary, of which an account is given elsewhere (pp. 467–72).

PREMIÈRE SECTION.

Statistiques Démographiques et Mathématiques.

1. Comparaison internationale des agglomérations urbaines. Bunle.
2. La statistique de la population éparsée. Kovacs et Thirring.
3. La courbe de la fécondité matrimoniale de la femme d’après l’âge. Gini.
4. Les causes de la mortinatalité en Italie en 1931. de Berardinis.
5. Le calcul du taux de nuptialité. Landsberg.
6. Certains aspects démographiques en Italie, avec quelques comparaisons internationales et particulièrement en ce qui concerne les caractéristiques sociales de la population. Giusti.

7. Les statistiques démographiques dans les pays tropicaux. Granville Edge.
8. Utilisation de l'anthropométrie militaire. Auerhan.
9. L'uniformité dans les limites de certains groupes statistiques. Huber.
10. La normalisation des tableaux statistiques. Drexel. (Report.)
11. L'usage du coefficient de corrélation. Frechet. (Report.)
12. Sur les inégalités statistiques. Mortara.
13. La discordance des indices de variabilité et de concentration. Pietra.
14. Les méthodes statistiques en psychologie. Irwin.
15. Some Recent Studies on Differential Fertility in the United States. Sydenstricker and Notestein.

DEUXIÈME SECTION.

Statistiques Économique.

1. Certaines circonstances qui, à l'époque moderne, tendent à faire paraître l'augmentation du revenu plus important qu'elle n'est en réalité. Gini. (Report.)
2. L'inclusion de la dette publique dans les évaluations de la richesse national. Einaudi.
3. Problèmes courants dans le mesure du revenu national. Mitchell and Kuznets.
4. La statistique du marché intérieur. Zahn. (Report.)
5. La statistique des trusts. Hecht. (Report.)
6. Le taux de capitalisation des actions. Bachi.
7. La statistique de la répartition des charges d'impôts. de Fellner.
8. Le montant du budget d'Alexandre le Grand. Andréadès.
9. Le nouveau cadastre agricole et forestier en Italie. Sitta.
10. Statistique de la petite industrie selon ses formes d'organisation. Szturm de Sztrem.
11. Classification des navires à vapeur et à moteur du Royaume-Uni. Isserlis.
12. Uniformité dans les statistiques des accidents de la circulation. van Zanten.
13. Effets du développement de la capacité de production sur les fluctuations de la vie économique. Livi et Golzio.
14. Les déséquilibres et désajustments économiques. Snyder.
15. Le modèle international dans les cycles économiques. Mitchell.
16. L'équilibre économique et la statistique en matière des fluctuations économiques. Pribram.
17. La statistique économique générale et la statistique dans l'économie des entreprises. Meyer.

18. Are Booms and Depressions transmitted internationally through Monetary Standards? Irving Fisher.
19. Sur les statistiques d'Émission de Capitaux et d'Intérêt de l'Argent. de Miguel.
20. The Debt Theory of Depressions. Irving Fisher.

TROISIÈME SECTION.

Statistiques Sociales.

1. Les aspects statistiques du problème de la nourriture nationale. Greenwood.
2. La méthode et les résultats principaux d'une enquête sur les budgets d'ouvriers et d'employés en Belgique. Julin.
3. La migration et le mouvement alternant. van Zanten. (Report.)
4. Reflexions sur la sociographie des maisons et logements. Thirring.
5. Le rôle de la confession et de la nationalité (langue maternelle) dans la statistique du mouvement de la population. Kovács.
6. L'intelligence surnormale considérée comme phénomène collectif. Wehr.
7. Note sur la suite à donner aux résolutions concernant la statistique intellectuelle. Simiand.
8. Tâches envisagées et tâches à envisager pour la commission des recherches statistiques historiques. Simiand.
9. La statistique des villes allemandes après la guerre. Büchner.

Note.—Copies of these papers can be consulted in the Statistical Library of the London School of Economics.—A. L. B.

MISCELLANEA.

INTERNAL PRICE STABILITY VERSUS EXCHANGE STABILITY.

A Note on Professor J. H. Jones's Paper.

By DR. ROBERT EISLER.

(This communication was received too late for printing with the discussion on Professor Jones's Paper.—Editors).

I SHOULD like to be allowed to comment on Prof. J. H. Jones's paper on "Exchange Stability versus Internal Price Stability," which I was privileged to hear as a guest of your Society on 20th February last.

In his discussion of the relative merits of an international standard and a national monetary system seeking internal price stability, Professor Jones consistently assumed (a) that an international standard assuring stability of exchanges could not be anything but the gold standard, (b) that a monetary system managed with a view to achieving internal price stability could not be controlled in any other way than through variations in the discount rate and open-market policy according to the methods advocated by Mr. Keynes and his followers. The author of the paper was, of course, entitled to delimit his subject in any way he chose, but if he wanted to avoid the criticism of having either overlooked, or deliberately ignored, the more recent and more important foreign literature on the subject, he ought to have entitled his paper "The Gold Standard in its classical pre-war form and its various post-war developments" (including the Roosevelt-Morgenthau-Warren "1934 model") versus Mr. Keynes's proposals of monetary reform.

As to point (a), Professor Jones has not said a word about the possibility of achieving complete stability of the exchanges by a system of bi-national treaties insuring the direct convertibility, at an agreed parity, of properly managed fiduciary currencies which was suggested simultaneously but independently in 1930 both by M. Bertrand Nogaro, the former French Minister of Finance and a Professor of the Sorbonne, and by me in my book "Stable Money, a Programme for the London International Conference of 1933" and in my evidence before the British Parliamentary Finance Committee (10th February, 1932) and before the United States Senate Committee on Banking and Currency (14th and 21st January, 1934).*

* Printed in "Gold Reserve Act of 1934, Hearings, etc.," 73rd Congress, 2nd Session on S. 2366, 20th January, U.S. Government Printing Office, pp. 181-198.

It may be that Professor Jones thinks that the world is not ripe for such a system of pegging the exchanges over a wide area by an exchange of mutual credits in the shape of regularly renewable three months Treasury Bills. But since he believes that the world is not ripe either for a return to the old or modernized gold standard, this does not seem a sufficient reason for refusing to discuss a system which claims to be able to achieve a stabilization of the exchanges while enabling the monetary authorities of the various countries to manage their respective currencies so as to reabsorb existing unemployment and to maintain full employment of labour and plant forever after—a result which cannot, of course, be achieved by mere “credit control.”

It is proposed to perfect and to extend to the whole of the Sterling Area, eventually to this region plus the United States of America, a system similar to the “Sterling Exchange Standard,” operated with such perfect success ever since 1916 between Egypt and Great Britain and since 1912 between Great Britain and the Colonies. If the British and the United States Treasuries were to agree on a certain par of exchange between the dollar and sterling, *e.g.* 1 : 5, they could exchange regularly-renewable three months Treasury Bills to the amount of, say, five billion dollars (\$5,000,000,000). If this were done, the two monetary systems would be linked together in such a way that the transfer of money from London to New York or vice versa would be as easy as the transfer from London to Edinburgh or from New York to Chicago. The British capitalist desiring, for one purpose or another, to transfer a £1,000,000 to New York, would surrender to the British Treasury account at the Bank of England a bank balance of £1,000,000 obtained, presumably, by selling some sort of investment to another British capitalist, and thereby depressing the price of that particular security to some extent; the Treasury could use this balance to redeem an equal amount of its short-term obligations, thereby slightly lowering the short-term rate of interest, with the result that £1,000,000 would be transferred from the account of the capitalist wanting to export this sum to the account of the former owners of £1,000,000 worth of British Treasury Bills—no expansion or contraction of the British monetary circulation resulting from the transaction. The result would not be very different if the Treasury chose to spend the million in question, instead of using it to redeem part of its indebtedness. In so far as business might be stimulated in this way, the money volume might increase (unless the amount is used for repaying Ways and Means Advances to the Bank of England without the Bank increasing its advances to other customers to the same extent). On the other side of the Atlantic the British Treasury would sell

\$5,000,000 worth of American Treasury Bills to someone willing to buy them, thereby slightly raising the short-term interest rate, and pay out the proceeds to the American payee to whom the British capitalist wants to transfer the sum in question, and, supposing that this gentleman does not immediately reinvest this sum, the short-term rate of interest will not be affected by the operation. A British capitalist owns now \$5,000,000 invested in the United States instead of owing £1,000,000 invested in Great Britain, the British Treasury owing eventually £1,000,000 less and owning \$5,000,000 less, the whole position as between the Treasuries on both sides being published in the same way as the weekly status of the various Central Banks. If the capital movements between the two countries do not balance—and this may be due to the evolution of the balance of trade or to the varying volume of long-term international lending, as well as to the short-term position—the situation may be righted either by an export of gold or silver (neither of the two precious metals being connected in a fixed ratio either with the pound or the dollar) or by consolidating the resulting short-term indebtedness from time to time through long-term borrowing. This desirable resumption of international lending would be greatly facilitated by the previous pegging of the exchanges.

The objection that in this way the debtor countries will get more and more indebted to the creditor countries will not impress those who remember that Great Britain has for centuries constantly reinvested interest and amortisation accruing on its foreign loans in the debtor countries, and that the process means nothing else but an ever-growing transfer of capital goods to countries which cannot manufacture them themselves (or at least not so well and not so cheaply). It is well known that only a war can reverse the relation as between debtor and creditor countries.

Supposing that the short-term rate of interest is identical in London and New York, it is obvious that neither the British nor the United States Treasury would incur any cost through redeeming an equivalent amount of Sterling Treasury bills whenever they sell dollar Treasury Bills to the public and vice versa. If, however, the discount rate is different on the two sides of the Atlantic—that being the problem envisaged by Prof. Jones—*e.g.* 2 per cent. in London and 3 per cent. in New York—the transfer of capital from the United Kingdom to the United States will cost the British Treasury 1 per cent. all through the time that this difference exists. This period must necessarily be very short, because the capital movement resulting from the differential rate would tend to raise the rate in the United Kingdom and to lower it in the United States. Obviously, the equalization could be speeded up by the very simple expedient of

making the Treasury Bills exchanged by the two governments marketable on both sides of the ocean. Bills issued by the one and accepted by the other Treasury in denominations of £5000 or £10,000, equal to \$25,000 or \$50,000 would be as easy to discount, to sell and to buy in London as in New York. The two Treasuries would sell their bills by preference in the market where the rate is lower, thereby automatically equalizing the rates on the two money markets.

Under such a system it would, of course, be difficult, if not impossible, to cure an industrial depression by lowering the national discount rate, say in the United Kingdom, below the rate prevailing in the United States, since that would encourage a flight of capital to the United States just as it would under the gold-standard system. But it would not prevent the much more efficient procedure of stimulating industry by means of Government Loan expenditure. The British Treasury could finance additional expenditure—*e.g.* for national equipment, for the purpose of armaments, or for the re-conditioning of slums—by having Treasury Bills discounted by the Bank of England. Since the interest on such bills is a profit accruing to the issuing department of the Bank, which under the law reverts to the Treasury, the rate of interest paid on such (inflationary) loans does not make any difference. As soon as industry is stimulated by additional expenditure, profitable investment for idle capital—including the newly created bank balances—is provided at home, and the stimulus for exporting it will be diminished or wholly counteracted.

If the United Kingdom and the United States had both been off gold in 1928, the problem discussed by Mr. Keynes ("Treatise on Money," p. 326) would have been perfectly soluble. The United States could have restricted speculation by a high discount rate, and might have offset the consequent influx of European capital by the Federal Reserve Board selling an equivalent volume of government securities, while the British Treasury might have stimulated industry actively by extensive orders—*e.g.* for building battle-ships on the Clyde, or houses in Glasgow and Aberdeen—given to the ship-building and building industries in the depressed northern area of the United Kingdom, and financed by the above described war-time methods of credit expansion. Prof. Jones's whole argument based on the different industrial situations in the north and the south of Great Britain is purely academic, since we are all aware of the fact that the industrial depression of the North could not have been righted anyhow even by a 1 per cent. discount rate.

Incidentally, Professor Jones does not seem to know that the various Federal Reserve Banks of the United States are almost always, certainly at the present time, maintaining different discount rates for their various reserve districts, the consequent movements

of liquid capital being insufficient to equalize these differences. On the other hand, it is a sophistical question to ask why Holland and Germany, or Germany and France, should not be considered, for the purpose of credit control, as a unit, if England, Wales, and Scotland are so treated. The obvious answer is because they are separated by tariff-barriers and compete against each other on the world's market for the available gold, with the result that each competitor wants to lower his own price-level below that of his neighbour.

If it were not for the necessity to increase available gold reserves by direct or indirect trade with gold-mining countries, no nation would strive to achieve what is paradoxically called a "favourable" balance of trade. But we are so accustomed to think in the terms of gold-standard economics, that we do not even notice how nonsensical it is to want to export more than the equivalent of what we need to import.

Professor Jones does not only ignore—deliberately or otherwise—the thesis of the advocates of the above-described system of internationally stabilized exchanges, which is perfectly compatible with a stable optimum price-level in each of the countries entering into such a monetary federation, but he equally ignores the whole of the research work which Professor François Divisia (*L'indice monétaire*, Paris, 1926) and Dr. Carl Snyder of the Federal Reserve Bank of New York have devoted to the index problem.

If he had taken into account Divisia's demonstration that the index of monetary purchase-power cannot be an index of unweighted wholesale prices, but that it must be an index corresponding to all the real transactions performed during the period in question, weighted according to the volume of transactions in each line of goods, he need not have worried about the problem of individual prices, depressed or raised by non-monetary factors, influencing the general price-level. If the price of a commodity falls because that commodity is not wanted to the same extent as before, its weight in the structure of the index must simply be reduced according to the reduced volume of transactions in that line of goods, and the weight of the substitute replacing it must be increased according to the increased volume of these sales. In this way a correct index of monetary purchase-power—a combined wholesale, retail, and stock-market price index constructed by Dr. Carl Snyder—is obtained, and the errors of the United States monetary policy of 1923-1926 can be wholly avoided.

Dr. Snyder has recently shown by conclusive evidence and striking diagrams that wholesale prices of basic commodities have, for obvious reasons, constantly fallen all through the nineteenth and twentieth centuries in relation to the prices of finished goods and

services, and that, therefore, an effort to maintain an index like the Sauerbeck index stable must lead to inflation and the resulting over-speculation on the Stock market.

It is obvious that the stabilization of prices in itself, which may mean the stabilization of a depression price-level and of the corresponding unemployment, can never be the object of a sound monetary policy. The primary object of monetary policy is the absorption of unemployment, as well of labour as of plant and capital. This can only be achieved through reflation. Ordinary inflation or reflation cannot be pursued far enough to achieve complete absorption of unemployment and the desirable excess demand for labour, because long before this end is achieved the expanded currency and credit volume of the inflating nations will buy less than it bought before it was inflated, simply because, in consequence of speculation, prices rise faster than incomes. Nothing but "compensated" reflation constantly compensating the consumer for any loss of purchase-power resulting from the depreciation of the monetary unit will do the trick. As long as we refuse to discuss this fundamental issue, our discussions will be purely academic, and of no interest to the business leaders and statesmen of the Anglo-Saxon world.

REVIEWS OF STATISTICAL AND ECONOMIC BOOKS.

CONTENTS.

	PAGE		PAGE
1.— <i>Zahn (Friedrich)</i> . 50 Années de l'Institut International de Statistique	484	8.—Das deutsche Volksein- kommen vor und nach dem Kriege. — <i>Elsas (M. J.)</i> . Volkswohlstand und Volkseinkommen ...	498
2.— <i>Ashton (T. S.)</i> . Economic and Social Investigations in Manchester, 1833-1933 ...	487	9.— <i>Jones (J. Harry)</i> . The Economics of Saving ...	500
3.— <i>Hutton (J. H.)</i> . Census of India, 1931. Vol. 1. India ...	488	10.— <i>Liefmann (Robert)</i> . Car- tels, Concerns and Trusts ...	501
4.—New Survey of London Life and Labour	490	11.— <i>Cohen (J. L.)</i> . Building Society Finance	502
5.— <i>Wilson (Sir Arnold)</i> . Walks and Talks	492	12.—International Labour Office and Institute of Agriculture. The Rural Exodus in Ger- many	504
6.— <i>Hawtrey (R. G.)</i> . Trade De- pression and the Way Out ...	494	13.— <i>Ellis (Lippert S.)</i> . The Tariff on Sugar	506
7.— <i>Edwards (D. S.)</i> . Gold Re- serves and the Monetary Standard.	496	14.— <i>Fellner (F. V. de)</i> . Com- munications in the Far East ...	507
		15.—Other New Publications ...	510

1.—50 *Années de l'Institut International de Statistique*. Par Friedrich Zahn, President de l'Institut. 1934. 10½" × 7½". vii + 181 pp.

This volume, although there is no imprint, appears to be published by the Institute itself at its permanent office at the Hague. We may at once congratulate Professor Zahn on an admirable piece of work, in which he has surveyed the history of the Institute and given an excellent systematic summary of the work done at the twenty-one sessions from its founding up to 1933. Like the Royal Statistical Society, the Institute traces its origin to Quetelet, who, in 1851 during the Great Exhibition, proposed the establishment of an International Statistical Congress. Nine such Congresses were held between 1853 and 1876 and much good work was done in unifying and harmonizing official statistics. The members were, however, all official representatives of the different Governments and, while they could agree upon schemes for improving statistics, they could not guarantee their acceptance by their several Governments. The plans proposed, like that of a "Statistique internationale de l'Europe" on a common plan for all States, were sometimes grandiose and were resented by the Governments to which they were presented. The authority of the Congress declined, and, besides, the festal character of the meetings—there were 751 persons present at Florence in 1867—was displeasing

to many of the statisticians; as von Neumann-Spallart said, "l'élément profane y avait trop de part." A permanent Commission was set up by the Congress in 1872 to supervise European statistics and its decisions were to be obligatory on the various Governments. It is not surprising that it quietly expired after 1878.

Although the end of the Congresses was somewhat inglorious, they had in part "filled a felt want," in affording a common meeting-place where official and other statisticians of all countries could make each other's acquaintance and exchange views on matters of common interest. The Jubilee meeting of the Royal Statistical Society was the occasion of a distinguished international gathering, and the establishment of a new international organization was placed on the agenda. Thus was born the International Statistical Institute for the purpose of "introducing uniformity in the methods of compiling and abstracting statistical returns," of pressing Governments to deal with "problems capable of solution by statistical observation," of preparing international publications, and of fostering "the general appreciation of statistical science." There were to be 100 members (afterwards raised to 200), honorary members (now limited to 20), and associates (a class now suppressed). At the time of the first biennial session in 1887 there were 156 members, in 1907 there were 220, a peak figure from which there was a decline to 204 in 1913; meetings were suspended during the War and the number of members fell to 155 in 1923. In 1933 there were 195 members, of whom 12 were honorary, and of these France claimed 24, the United Kingdom 23, Germany 22, the United States 20, and Italy 17.

Warned by the experiences of the Congresses, the founders of the Institute made it entirely free from association with the Governments and laid the chief stress on the importance of dealing with practical questions. The connexion with official statisticians is, nevertheless, close, and thus the various recommendations to Governments are kept within the limits of what is reasonable. Continuity between the biennial meetings is maintained through the Bureau (which consists of the President, three Vice-Presidents, the Secretary, and the Treasurer), the permanent office at the Hague, and the Bulletin (at first monthly, now quarterly). Members of the Institute are elected by the existing members from the eminent representatives of administrative statistics and of scientific statistics; the directors of statistical departments and members of statistical councils and of state and municipal statistical departments constitute the first group, academic statisticians and members of statistical societies the second. The work of the Institute is divided into three sections, demographic, economic, and social, and the proposals coming before the biennial meetings are carefully elaborated beforehand and reduced to practical form by committees working during the inter-sessional periods. The Permanent Bureau or Office was established in 1913 to publish statistical annuals, bulletins, etc., to maintain the library and archives, and to prepare the programmes for the Sessions. Although the Institute is quite independent of all governments, the Permanent Bureau receives subventions from the Netherlands Government, from the town of the Hague, from several other governments, and from statistical societies.

The Institute is also kept in touch with official statistics through their practice of inviting governments to send delegates to the biennial meetings. Friendly relations are also maintained with the League of Nations and other international bodies in order to avoid as far as possible the risk of overlapping.

The greater part of the book is occupied with a digest of the reports and papers presented to the Institute, grouped in the following manner: A. Theoretic statistics:—organization, method. B. Practical Statistics: 1. Population—censuses, natural movement of population, health, migration; 2. Economic Statistics—occupational nomenclature, agriculture (with forests and fishing), industry and trade, transport, money and credit, prices and consumption, public finance, social statistics, national income and wealth, forecasting; 3. Cultural Statistics—moral, intellectual, statistical. This summary will be found extremely useful by all who wish to know what the Institute has done with regard to any particular subject and to be guided to the full discussion. To summarize a summary is to trespass on the jejune and futile, so no attempt will be made here to make a further *précis*. It is interesting to note that out of the 118 pages of digest 14 are given to the natural movement of the population (births, deaths, etc.), 14 to social statistics (chiefly labour), 12 to industry and commerce, 9 to prices and consumption, 9 to population statistics (censuses, etc.), 6 to agriculture, forestry, and fishing, and 5 to questions of statistical method. The fact that so very many of the members are official statisticians explains the preoccupation of the Institute with practical questions, but, even after account has been taken of the contributions of Edgeworth, Yule, Borel, Bortkiewicz, and others, one would still have expected some further treatment, some selection, and some systematizing of modern mathematical methods. New weapons are being manufactured almost every day for the attack of statistical problems, and it would be extremely useful if they were discussed not only by those who deal with abstract propositions, but by those who have to interpret concrete data for the instruction of governments. Already the new research section of our own Society is showing how apparently abstruse methods can be used for the solution of industrial and agricultural problems.

In looking at the personal statistics of the Institute, one is struck by the conservatism of the Bureau. Throughout the 50 years there have been only five Presidents (Sir Rawson W. Rawson, K. T. von Inama-Sternegg, L. Bodio, A. Delatour, and F. Zahn), 14 Vice-Presidents, 4 Secretaries (L. Bodio, Major Craigie, C. A. Verrijn Stuart, and H. W. Methorst), and 5 Treasurers (J. B. Martin, Sir A. E. Bateman, Major Craigie, Sir R. H. Rew, and A. L. Bowley). It is, perhaps, unbecoming in an outsider to criticize, but one feels that there are advantages in having an executive which responds readily to new demands without forgetting the importance of maintaining a continuity of policy. However that may be, the Institute can look back with some pride on its past, and all Fellows of the Society which assisted at its birth will wish it long life and prosperity and an even greater activity in assisting to solve the theoretical and practical problems which lie before us.

H. W. M.

2.—*Economic and Social Investigations in Manchester, 1833–1933; A Centenary History of the Manchester Statistical Society.* By T. S. Ashton, Reader in Currency and Public Finance in the University of Manchester. King, 1934. 8 $\frac{3}{4}$ " \times 5 $\frac{3}{4}$ ". xii + 179 pp. 5s.

The Manchester Statistical Society, we all know, was founded in the autumn of 1833, when a group of men interested in social work discovered that their success was dependent on the accurate ascertainment of the facts relating to the condition of the people. William Langton, banker, Dr. Kay (better known as Sir James Kay-Shuttleworth), physician, Samuel Greg, cotton spinner, W. R. Greg, cotton spinner and (later) Commissioner of Customs, and Benjamin Heywood, banker, were the founders of the Society. They turned their attention first to the condition of the working classes in Lancashire, their education, food, and morals, and controlled the results of their enquiries by parallel investigations into rural districts and residential towns. Between 1834 and 1841 twenty-three reports were prepared and presented, and the sixty-three papers read during the first nine sessions also dealt chiefly with local problems and conditions. This was no small achievement for a Society which began with 28 members and had only grown to 60 in 1840, and was rendered possible only by the enthusiasm of the members and the generosity of Benjamin Heywood. The pace could not be kept up, and the eight sessions ending 1849–50 show a meagre list of fifteen papers by seven authors (Dr. Robertson contributing eight), while no records at all exist for the sessions 1846–47 and 1848–49. A revival followed and the publication of the *Transactions* of the Society was begun for the session 1853–54. The number of members slowly grew to 214 in 1879, then fell to 160 in 1894, rose again to 219 in 1902, fell to 142 in 1920, had a sharp recovery to 226 and 227 in the two following years, and once more declined to 170 in 1932 with a slight rise to 176 in 1933.

As with the London Society, the topics handled at Manchester reflected the subjects which were occupying the public mind at the time, but vital statistics, education, and crime bulk largely in the records. Gradually the scope widened to include production (in particular the cotton industry) and finance. It is a particular pride of the Society that Professor W. Stanley Jevons was one of its pillars from 1865 to 1876. Of the later readers of papers it is not necessary to say anything here, except that they include many who were also active in the London Society.

Mr. Ashton has done his work admirably, and it is a distinct merit that he has displayed the activity of the Society against the background of the evil conditions of the first half of the nineteenth century. In this respect his book is a valuable piece of social history, and one can have no doubt that the self-sacrificing efforts of the 50 or 60 men who belonged to the Society during its first decade were a powerful influence towards reform, not only through local work but in communications to the British Association. The President of the Society, the Earl of Crawford and Balcarres, contributes an Introduction to the book, in which he expresses a well-founded fear that "the increasing complexity of current statistical research, and the growing accuracy of system arising from more precise definition and

more exact methods of presentation, are giving rise to a new danger—namely, that of congestion.” In Appendices are given a list of the Presidents, statistics of membership, a sessional list of reports and papers, and an index of authors with their papers; this last list was compiled by our Fellow, Mr. Barnard Ellinger.

It will, we hope, not be held presumptuous if the junior, but Royal, Society, which has now also celebrated its Centenary, should extend its congratulations to its, slightly, elder brother and express its best wishes for the future; in particular we would echo Lord Crawford's commendation to Lancashire men of the new and less formal Study Groups of the Society. Finally, we would repeat our thanks to Mr. Ashton for his book, a book which places all students of statistics under a deep obligation to him.

H. W. M.

3.—*Census of India, 1931*. Vol. I. India. Part I. Report by J. H. Hutton. Delhi: Manager of Publications, 1933. 518 pp. 13" × 8½". 15s.

Whatever judgment may finally be passed upon the British occupation of India, there can be no doubt that the taking of the census will rank as a very remarkable and valuable achievement. The inhabitants of India comprise nearly one-fifth of the population of the world, and only 8 per cent. of them are literate. Nevertheless the enumeration reaches a very high degree of accuracy which does not fall much behind that customary in the western world. The collection of vital statistics, on the other hand, presents difficulties which cannot yet be overcome; figures of births and deaths are said to be in general 20 per cent. deficient, and in some places, Mysore for instance, 50 per cent. deficient. The taking of this census, which was in the able hands of Dr. J. H. Hutton, was more difficult than usual because it coincided with an outburst of Congress activity and with a government economy campaign. The notification of the Congress Committee that January 11th, 1931, was to be observed as Census Boycott Sunday did not aid Dr. Hutton, nor was it helpful to find occupation recorded as “Bande Mataram.”

These troubles were surmounted, however, and attention first fixes upon the total enumerated population which, owing to defective vital statistics, can only be very roughly estimated for intercensal dates. The population was found to amount to just under 353 millions, which is over four and half millions more than is arrived at by using the figures for the decennial natural increase, and represents an increase of 10.6 per cent. over 1921. Conditions during the decade were favourable; crops were good, famines were rare, floods were few and there were no serious epidemics. Unlike the position in western countries, the movement of the population of India is closely dependent upon material surroundings. There is no general trend, as in the west, reflecting the dominance of social conditions; instead we find fluctuations exhibiting the dominance of the weather and allied phenomena. The six decades, for which we have information as to India, exhibit an alternation between an increase so trivial as to amount to practical stability, and an increase varying from 6.4 per cent. to 10.6 per cent.—three decades of stability alternating with

three decades of moderate rate of increase. The decade 1921-1931 showed the highest recorded rate of increase (10.6 per cent.), and this implied an addition of nearly 34 millions to the population. The density of population for the whole area is 195 persons per square mile, and this is much greater than the density for Europe (127 per square mile), and almost exactly the same as that of France. The density is very variable; in Baluchistan it is only 6.5 per square mile, while in Bengal, with over 51 million inhabitants, it is 616 per square mile.

This high density and recent relatively high rate of increase suggest reflections upon the relation between population and poverty in India. In an appendix to the first chapter Mr. Porter finds some comfort as the result of applying Professor Raymond Pearl's logistic curve to the population of Bengal. But there are few who are now inclined to attach much importance to this approach to the population problem. Most readers will take more note of various facts scattered in the volume and will gain little assurance from them. We read, for instance, that "the constant figure for mean age at this census as compared with previous ones, and in conjunction with the consistency of the decennial age groups, suggests that the expectation of life has not much altered since 1891." It is not reassuring to find that the proportion of the population engaged in industry and trade has decreased during the decade, whereas the proportion directly dependent upon the land shows little change. The dependence upon the land of the same proportion as ten years ago of a larger population indicates an increasing pressure upon natural resources. There are facts in the Report, such as those concerned with housing, which indicate a very low standard of living. In Bombay a one-roomed tenement normally varies from 10 × 10 feet to 12 × 15 feet; the average population per room is more than four persons, and over a quarter of the population of the city lives at over six persons per room. The chapter on infirmities gives a total of 600,000 blind persons, and the incidence of blindness and of other infirmities seems to be on the increase. The possibilities offered by migration give little hope of a way out. There are about two and a half million Indians living outside India, and about three quarters of a million foreign born living in India. The total number of emigrants from India during the decade was about one million of whom about half a million went to Malaya. Whatever may be the psychological value of outlets for a few migrants, it is obvious that, considered quantitatively, migration is of no importance. In the minds of many readers the most hopeful fact contained in the report will be that in 1930 the government of Mysore sanctioned the establishment of birth-control clinics in the four principal hospitals of the state.

One of the features of the situation, upon which any reader of the Indian census hopes to gain information, is the extent of infant marriage and the amount of widowhood. There can be no doubt about the misery involved by infant marriage and widowhood in that country. It is well known that from 1881 to 1921 there was a welcome decrease in the number per 1,000 of girls aged 0 to 15 who were married. It may be noted incidentally that, so far as infant marriage

is inimical to child bearing, this change tends to raise the birth-rate; so also would any loosening of the ban upon widow remarriage. Nevertheless decrease in child marriage and in widowhood is obviously very desirable. How have matters moved during the last decade? The present situation is largely the result of the Sarda (Child Marriage Restraint) Act of 1930. This Act provides penalties for the solemnization of marriages of boys under 18 and of girls under 14, but does not invalidate them. To put the Act into operation a private person must take action, and, if the prosecution fails, the prosecutor is liable to penalty. Since hardly anyone is willing to prosecute under this procedure, the Act is a dead letter and has not checked child marriage. But when the Act was passed it was not realized that it would be inoperative, and the interval between the passing of the Act and its coming into operation was spent in hastening child marriages before they became liable to penalty. In consequence the proportion of girls per 1,000 aged 0 to 15 who were married in 1931 has almost reverted to that of 1881. No doubt a further deplorable consequence will be a rise in the years to come of the proportion of females who are widowed, whereas during the last decade there was a gratifying decline. Could there be a better example of well-meaning but ill-advised legislation? Another curious result of this Act has been that the number of males returned as married exceeds the number of females returned as married—and this in a country where there is much polygamy. Evidently there has been much concealment of the marriage of young girls from the fear that disclosure would give grounds for prosecution.

There is no room here to do more than mention the final chapters on the language, caste, religion and the racial origin of the inhabitants of India. Dr. Hutton and his staff deserve the thanks of all those interested in the welfare of this sub-continent. A. M. C-S.

4.—*The New Survey of London Life and Labour*. Vol. VI. Survey of Social Conditions. (2) The Western Area. (Text.) xvi + 468 pp. Vol. VII. Social Survey. (2) Western Area. (Maps.) London: P. S. King & Son, Ltd., 1934. 8½" × 5½". 17s. 6d. each volume.

The present volume of the new London survey, together with its companion volume of maps, continues and completes the survey of social conditions which was begun in Volumes III and IV (dealing with the Eastern area and reviewed in the *Journal*, 1933, p. 108). The same methods of enquiry—a street survey and a house sample analysis—have been applied in the Western area, which included 14,000 streets and nearly three-and-a-quarter million inhabitants. The proportion of the population living in this sector who were in poverty (as defined in the survey) was somewhat less (7·2 per cent.) than was found in the Eastern area (10·6 per cent.), the improvement that has taken place over the past forty years being greater in the Western area. In both sections the apparent causes of poverty are closely alike with insufficient employment responsible for nearly half the total cases and inadequacy of wages for the size of family for just under one-fifth. The final impression left by the results of the now

completed social survey is, the Director, Sir Hubert Llewellyn Smith, suggests, "one of hope tempered by anxiety." On the one hand we have the vast diminution of poverty in its severest forms that has taken place over the past forty years and the considerable general improvement in the standards of life; on the other, nearly half a million of the inhabitants of the surveyed area still living in 1929 below "a poverty line fixed according to the low standards of a past generation," much of which is derived from lack of employment and denotes a "dynamic" poverty which may cause more conscious distress than the "static" poverty due to a low customary standard of living. The actual improvement in social conditions that has taken place is in large part derived, as the Director points out, from the sustained efforts on the part of the community, as is evidenced in such measures as Old Age Pensions, Social Insurance and the Trade Board Acts. Yet too rapid an advance in one direction may retard progress in another. Too rapid an increase in wages or too large a burden upon industry may add to the volume of unemployment. Further efforts to reduce the still regrettably high level of poverty can, in fact, only be rightly directed upon as wide a basis of ascertained fact as it is possible to secure. This basis—the *raison d'être* of the survey—has been carefully laid and very clearly set out in this and the previous volume dealing with the Eastern area. In addition to this main issue, however, the present volume contains a number of valuable studies of specific problems of London's life, namely, the housing problem, the migration of population, the Jewish element in East London, household economy and cookery in relation to poverty, and mental deficiency. One of the most interesting studies is that dealing with migration, the main feature of which in London is no longer the absorption of the country immigrant but the centrifugal movement of industry and population from the congested central areas to the outskirts. The movement into London from more distant areas has changed also in its origin, the number of immigrants from the home counties, Essex, Kent, Middlesex, and Surrey, having declined, while the numbers from the industrial North and the South Wales urban areas have enormously increased. It seems, therefore, that London County is becoming more and more a community born in urban surroundings. "The type of migrant whom London now attracts is not so much the low-paid agricultural labourer who expects to make his fortune, as the unemployed townsman of the 'depressed areas' who hopes to find a job." This is a feature which may affect London's general standard of health, especially when combined with the greatly increased, and possibly selective, efflux to the more outlying districts of the Metropolitan counties. Incidentally, the measure of health used in the Borough Summaries, at the end of the volume,—namely, the crude death-rate—is not very helpful. For instance, it is stated of Hampstead that "the birth-rate (mean of the five years 1927-31) is 11.5 per 1,000 of population. There are only two of the 37 boroughs in the Survey Area showing lower rates. The death-rate (12.1) is not exceptionally low." To avoid misconception it should have been stated that this comparison is based upon crude rates which cannot

give a true aspect either of fertility or of the hygienic advantages or disadvantages of an area.

The chapter on household economy and cookery is more descriptive than statistical—a return to the methods of the earlier statisticians which Professor Greenwood recently suggested might well be of value in the study of national nutrition (in a paper read to the London meeting of the International Statistical Institute). Some material was collected in a small series of questionnaires, but as such answers could certainly not be representative of London's poorer element, opinions and information were also secured from many other sources. Some of the more striking conclusions are that though tinned fruits and other tinned foods are largely consumed, the dependence of the housewife on tinned goods appears on the whole to be less than in the past; that one respect in which real progress has been made of recent years is in the food given to the children (largely to be attributed to the work of the Welfare Centres); that the deliberate waste of food is a good deal less in evidence than it was a generation ago, though the habit of leaving food uneaten on the plate is still, apparently, regarded as good manners; and that the profit to the girls of their cookery lessons at school seems to be inadequate to the time and labour spent upon them owing to the long time which elapses between the years of learning and the years of practice.

In the chapter on the Jewish working-class community in East London it is concluded that this section of the population is still on the whole a poor community, though, in spite of its growth, it is no longer a serious factor in the causation of poverty. From the section on mental deficiency the main inference drawn is that it cannot be regarded as an important source of poverty in the general community, but is fostered and perpetuated by the conditions of slum life and degraded environment which encourage interbreeding.

It is hoped that this outline of the contents of the present volume, which calls for so little criticism, will be sufficient to convince the reader that it maintains the standard of interest and clarity which characterized its predecessors.

A. B. H.

5.—*Walks and Talks*: The Diary of a Member of Parliament in 1933-4. By Sir Arnold Wilson, K.C.I.E., etc. London: Oxford University Press, Humphrey Milford, 1934. 8 $\frac{3}{4}$ " \times 5 $\frac{3}{4}$ ". xv + 241 pp. 5s.

A hundred years ago, when the Royal Statistical Society was getting itself born, thoughtful men were gravely concerned about "the condition of England question." There were few statistics, information was scanty, Carlyle could only select special cases—the St. Ives workhouse, Dr. Alison's disclosures about Edinburgh. So the young Society set out to see for itself by enquiries in St. George's in the East, in Westminster, and elsewhere. To-day things are far different. Our flocks and herds are numbered, the produce of the land and the output of the factories are recorded. We know the numbers employed in every occupation and industry; we know, too, the numbers of those who cannot find work and of those who have been forced off the land. We know the numbers of vagrants,

we know numbers of things about all kinds of subjects; we have reams and reams of statistics issued weekly, monthly, and annually. What does it all mean, what do those serried rows of figures, those endless tables, signify? Figures by themselves mean nothing; what we must find out is their importance in terms of flesh and blood. No doubt there has been a great increase in population and an enormous growth of production; has not Mr. Walter Elliot lately been telling us of the improved activity of an "egg-laying hen"?

Sir Arnold Wilson, Fellow of this Society and Member of Parliament for Hitchin, comes forward to tell us what these things mean when measured by the welfare and livelihood of his constituents. "Why all this about India?" said a girl leaving one of his election meetings; "why doesn't he talk about 'Itchin'?" Therefore, when Parliament adjourned he set out to qualify himself to "talk about 'Itchin'." He tramped his constituency from end to end, from village to village, talking to everyone he met—the rector, the schoolmaster, the farmer, the butcher's boy, the tramp, factory hands, the bus-conductor, the men he met in trains, the men with whom he gossiped over a friendly glass of ale in the village inn. We see the purely rural areas where the farmers, though losing money, are sticking doggedly to their duty because they do not want to dismiss their men. We see the growth of the factory system invading the Home Counties, and learn how the bicycle enables men to combine village life with town work. Everybody talks frankly and sturdily—there is no whining, though not a little wild language and wilder theorizing. Sir Arnold has the merit of inspiring confidence and eliciting confidences, and in his turn, when challenged, he never "smiling put the question by." Every night the substance of his talks was put down on paper, and their collection forms this book. And it is a book, a live book, worthy to be set beside Arthur Young's *Tours* and Cobbett's *Rural Rides*, as important for its economic and sociological information and, if one dare say it, more readable. It is a revelation of the life of the people of this little patch of England, and, more, it is a revelation of the author himself—large-hearted, strong-minded, forcible, eager to know and to do, unwilling to sit still and do nothing. His views on men and things are scattered through the book, expressed without restraint—whether on the curse of speed or the inability of general laws to fit particular cases. At the end of the book they are gathered into a "Credo," which he who will may disregard; one reviewer would confess to a large measure of similarity of opinion though not to complete identity. What matters most is the opinions of the men whom Sir Arnold met, the men in the fields, the men on the roads, the men in the workshops, and it is highly probable that many on reading about them will experience surprise and a shaking up of views. The common man is thinking seriously about serious matters. The picture of Hertfordshire is, on the whole, a favourable one, and looks all the brighter when compared with the report of a visit to Durham. But there are black streaks on the picture, one of which is the unemployed man on tramp. Why do not the trade unions

go back to one old practice and issue travelling-tickets to men willing to go afield in search of work? That course would at least enable the authorities to separate such men from the work-shy professionals and treat them differently.

The literary quality of the book is high. This reviewer would have pardoned much—but it was not necessary—to a writer who is a friend to the author of *Piers Plowman*; even the compulsion to “prepare” that great book for an examination over fifty years ago has not dimmed admiration for one of the great poems of our language. Familiarity with the words of the Preacher adds vigour to many a comment. So one could go on for ever, but one cannot omit those swedes; how good they were in one’s boyhood, and how the farmer hated us for despoiling his fields! We must end, but to one and all we say: “Read this book: it puts the meaning into statistics.”

H. W. M.

6.—*Trade Depression and the Way Out*. R. G. Hawtrey. 2nd Edition. London: Longmans, Green. 1933. 8 $\frac{3}{4}$ " \times 5 $\frac{1}{2}$ ". ix + 183 pp. 7s. 6d. net.

This book is something more than a reprint of the pamphlet issued under the same name in 1931. Not only has it been brought up to date, but it has been expanded by the addition of new matter, largely of a theoretical nature. The earlier work was published at the beginning of September 1931, so that the new section of the historical survey covers the period during which both Great Britain and U.S.A. went off the gold standard. Needless to remark, Mr. Hawtrey has packed a mass of valuable information into a comparatively brief account of the two eventful years between the autumn of 1931 and the autumn of 1933. More space is given to a survey of various theories brought forward to explain the crisis of 1931 and the ensuing depression. The author considers briefly the views of those who trace the depression not to deflation but to inflation. There is also a fuller discussion of how far over-production, either of primary goods or of consumable goods in general, can be held responsible for the present situation, and attention is given to the theory that the technological changes in the years immediately preceding the crisis have led to a fundamental breakdown of the economic system. Though he thinks this not likely, the author takes a guarded line: “we cannot be *certain* that there are not underlying causes of economic disequilibrium. It *may* be that technological improvements were already threatening a big dislocation . . . in 1929.” But if this is so, he argues, credit restriction was all the more a “disastrous blunder,” and “*in the absence* of a sound monetary policy, monetary instability will confuse the issues, and leave us utterly uncertain as to the character and extent of the problems to be solved.” But assuming there was no fundamental dislocation threatening in 1929, but some inequality of development: “If the over-developed industries threatened to engender the deflation bacillus, the under-developed industries threatened to engender the inflation bacillus. It was the behaviour of the banking system that decided which of the two was to prevail.” That last sentence is

the burden of his argument. The economic disasters of recent years, in his view, were preventable and are curable. The cause was a monetary one. It is the central banks that are the villains, or perhaps one should say the fools, of the piece, by their mistaken discount policies, though the Bank of France has been sinned against as well as sinning, since the excessive absorption, and consequent sterilization of gold by France in 1929 was, Mr. Hawtrey considers, inevitable in view of the limitation on the powers of investment of the Bank of France. Non-monetary explanations cannot, in his view, explain the depression unless they explain the shrinkage of demand, and "the shrinkage of demand is simply a shrinkage of the flow of money." Nor will he accept the view that trade activity necessarily moves in cycles, and that there was bound eventually to be a reaction from the prosperity of 1929. The experience of the past on which this view is based "was limited to the working of a defective system of credit regulation." But if the system of credit regulation was faulty of old, it has been more so in the immediate past. "If we seek an explanation of the unparalleled severity of the depression, we shall find it primarily in the fact that the credit restriction of 1928-29 was imposed at a time when there was no inflation to be corrected."

Mr. Hawtrey's cure for the world depression is, as is well known, cheap money. In the original pamphlet he wrote: "The *only* real remedy is the expansion of credit by the central banks." That still remains his conviction, and is the focal point of the present book. Other cures have been put forward since he first wrote, and some of these are considered in this edition, notably Mr. Keynes's policy of extended capital outlay on the part of the government, a policy which Mr. Hawtrey considers both slower and less certain than extended lending by the banks. He is of course unashamedly an inflationist. Since deflation has in the past been applied as a corrective of excessive inflation, it has been given "the status of an austere and painful virtue." In the present circumstances he regards it instead as a "crime against humanity." There has, however, in his view been considerable misunderstanding of the benefits of deflation. It is not, he considers, a matter of a relative stimulus to exports. "The benefit that a country derives from the depreciation of its currency is in the rise of its price-level relative to its wage level, and does not depend on its competitive advantage. If other countries depreciate their currencies, its competitive advantage is destroyed, but the advantage of the price-level remains, both to it and to them."

These brief extracts taken out of their context sound perhaps not free from a certain crudeness and do the book less than justice. It is true Mr. Hawtrey's views with regard to the economic depression centre round one idea and one idea only, but there is so much of knowledge and thought in the working out, that his arguments fall more into focus than perhaps isolated excerpts suggest. In any case, whether one agrees with him or not, it is certain that those who were interested in the previous short version of this book will find the new matter well worth consideration, and those to

whom the whole book is new will certainly find it stimulating and thought-provoking.

W. A. E.

7.—*Gold Reserves and the Monetary Standard, with special reference to the position of the Bank of England: and an Outline of a Proposed Monetary System for the British Commonwealth of Nations.* By D. S. Edwards, B.Com., London: P. S. King, 1933. viii + 148 pp. 5s. net.

The author describes the aim of this essay not as an attempt to cover the methods by which the present imbroglio can be smoothed out, but to discuss what he somewhat strangely terms the "Sanierung" of the monetary system necessary to eliminate the danger of insufficient gold supplies and their one-sided use, and to safeguard it from injuriously fluctuating exchanges and price levels. The first chapter gives a not particularly illuminating survey of recent history, and a chapter is devoted to a consideration of the reports of the Gold Delegation of the League of Nations. The author pours scorn on their work, though even by the time one has finished reading his strictures it is somewhat difficult to lay one's finger exactly on his points of disagreement. One is left with a definite impression that he regards the gold standard as a completely worn-out mechanism, though his reasons for thinking so are never explicitly given. Mr. Edwards' views on the attitude of other writers are, however, of less importance than the question whether his own proposal has any positive contribution to make to present controversies.

The plan outlined in this book is not intended to come into force until such time as it seems possible to stabilize the pound, the gold value of the sovereign being then once again definitely fixed at some suitable parity. On the purely administrative side the proposals are not without interest. The author aims at securing, in the first place, greater stability within the British Empire and allows, therefore, for the representation of the Dominions on the central currency authority, which he suggests should take the form of a currency board closely linked to, but separate from, the Bank of England. Membership would include representatives of the Bank of England, of commercial banks and the foreign exchange market, of the Dominions, and of the Universities and learned societies, including the Royal Statistical Society. But not even the presence of a representative of the Statistical Society would make the Board successful if the currency system it had to work were not well devised. It is this that is the crux of the matter. The main duty of the Board would be to fix at frequent intervals the amount of the fiduciary issue, but on what basis this should be done is never stated. It may be presumed that the volume of currency would be regulated so as to give stable prices, but if this is the aim the reader is left to guess it and the method is never worked out. As to gold, the Bank will be bound to buy gold at a fixed price and the gold bullion market would be left undisturbed, but gold for export would only be given against notes if it were intended for one of the countries linked up in the monetary standard agreement. These countries will have to undertake that

any gold movements arising out of temporary deficiencies on the balance of international payments will be allowed to work out the full normal gold standard effects, credit being contracted when gold is withdrawn and expanded when gold is received. This proviso, when one thinks out all its implications, is surely rather astonishing for an avowed believer in managed currencies, even though it is aimed at the swollen gold reserves of the U.S. and France. (This book, it must be noted, was written over a year ago.) Shipments to these countries from the area of the Commonwealth monetary agreement might be ruled out. The author then proceeds to a categorical statement that if gold again tended to rise in value the nations of the Commonwealth currency area "would have the satisfaction of knowing that price levels within their own areas would not copy the full fury of the downward movement in France and the United States, owing to the ban on movements of the gold behind the note issue to those countries." But the question how far one country, or group of countries, can protect itself against world price movements is not so simple, and no attempt is made to show how the position would work itself out, nor what rôle, if any, the note issue would play. Actually it would seem as if the position in the Commonwealth currency area would be exactly the same as that existing to-day in those countries which have a nominal gold standard combined with a ban on gold exports; countries which, be it noted, have *not* been able to maintain their price levels. The sole difference is the substitution of a political unit geographically scattered for a geographically undivided unit, and this obviously does not affect the situation in essentials, however large the unit.

Ultimately the author hopes that France and the U.S. as well as other countries would adhere to the monetary agreement, either individually or in groups. If all countries come in it is difficult to grasp, and Mr. Edwards does not explain, how this brave new world differs from the pre-war world when the currency effects of gold movements were normally worked out to the full, except for the one fact that there would be an elastic instead of a fixed fiduciary issue. This is by no means a new proposal, and the other writers who have suggested it have generally conveyed a clearer idea to the reader of how the note issue should be handled. The plan put forward by Mr. Edwards might provide a method of bridging over the transition from the present impasse to a normal gold standard world, and the linking up of countries into larger monetary unions may be valuable, but even these theses need fuller consideration than they are given here. It would be useful too to prevent the sterilization of gold reserves such as has occurred in the U.S. and France, but if these countries felt it both desirable and possible to utilize all their gold as a basis of currency it would not need the suggested monetary agreements to make them direct their policy accordingly.

When Mr. Edwards next produces a book we trust he will elaborate his arguments more fully. His style, however, needs no further elaboration! His excursions into the deliberately picturesque are more irritating than vivid.

W. A. E

8.—(1) *Das deutsche Volkseinkommen vor und nach dem Kriege.* (Einzelschriften zur Statistik des Deutschen Reichs No. 21.) Berlin: Reimar Hobbing. 1934. 11 $\frac{3}{4}$ " \times 8 $\frac{1}{2}$ ". 196 pp. 8 Rm.

(2) *Volkswohlstand und Volkseinkommen.* By Dr. M. J. Elsas. Probleme der Konjunkturforschung—Vol. 1. Leipzig: Hans Buske. 1934. 9" \times 6 $\frac{1}{4}$ ". 90 pp. 4.60 Rm.

The Dawes Plan, with its so-called "prosperity index," focussed attention in Germany on questions of national income and prosperity. Hence a vast production of literature of which two interesting examples are before us.

Germany, with its income tax on wages and highly developed system of social insurance, offers a fine field of research, and the Statistical Office's monograph on German National income in the periods 1891–1913 and 1925–31 is a rich mine of information. National Income or the social product is here defined as "the total of goods or services possessed of money value, at the disposal of the community in a given year—whether for consumption or provision of capital after providing for the maintenance of the original condition." This would seem to be the German version of Professor Marshall's "net sum total of things and services produced." The monograph deals with comparative levels of "prosperity" in Germany by giving the percentage of the average income per head in a given German State to the average income per head in the Reich.

Nominal prosperity at different times is arrived at by giving these figures for the years 1913, 1926 and 1928. Real prosperity is estimated by reducing the 1913 and 1926 figures to the common denominator of the purchasing power of 1928, based on the official cost of living index.

The result of this enquiry shows that per head of the population throughout the Reich (post-War territory) the income of 1928 was nominally 155 per cent. of 1913 and 119 per cent. of 1926. In purchasing power parity it was 102 per cent. of 1913 and 111 per cent. of 1926.

Dr. Elsas is more subtle in his conception of prosperity. He rejects the average income in favour of the typical. The distribution of national prosperity among the different classes is itself so decisive for national prosperity, that even a country where the addition of the different income figures gave arithmetically a greater prosperity, might from the social standpoint be less favourably placed than a country with a relatively smaller total but a more even distribution of income. National prosperity, from a social point of view, he says, is the prosperity of the masses, but this cannot be taken as an expression of the prosperity of society as a whole. It is, indeed, problematical whether this last can be calculated at all. He tentatively constructs an index of social prosperity by extending the index of the prosperity of the masses by an index of capital movements. Mass prosperity is shown by movements of real wages (nominal wages divided by cost of living) as modified by the amount of employment. He gives a weight of 70 to this part of the index, choosing this figure as being roughly the proportion of wages in

German National income. He then completes the index by a capital index made up of figures symptomatic of the increase or shrinkage of the capital cover. "These symptoms make it possible to conclude whether a given mass prosperity is justified by the supply of capital. Mass prosperity may reach a position unjustified by the facts, *e.g.* wages may be raised by a decision of an arbitrator when the supply of capital is not rising or is even decreasing. This undue increase of wages will increase unemployment and so force an adjustment to the supply of capital." Capital cover and mass prosperity are therefore in the long run causally connected. Dr. Elsas thinks that when an index is homogeneously constructed, the causal connection between the different factors gives an insight into the progress of development of prosperity and to a certain extent gives a basis for prognosis. But since the two parts of the index are connected only in the long run, in view of the dangers of a time lag it would be rather less unsafe for prophecy to consider the factors separately. In fact an index of "prosperity" is too ambiguous in conception to be any use.

Dr. Elsas devotes the second part of his book to the dynamics of wages, that is the reaction of wages and unemployment. He criticizes the theory that English unemployment is a function of the price level and also M. Rueff's theory of the connection between unemployment and real wages. "In the case of Germany and France also no direct connection between unemployment and wages can be proved. For England, where the two curves correspond fairly well (though in different degrees in different industries in accordance with whether they are work intensive or capital intensive), it must be noted that nominal wages in the critical period were with a few minor exceptions stable, and that therefore the alteration of the curves in the year 1923-29 was exclusively brought about by prices."

M. Rueff's thesis, even though it held good for England for a given time; is not yet proved, otherwise it would hold good in all cases, and not only for a country where wages remained stable throughout a period of years. It would have to hold good in the converse case, *i.e.* if real wages fell. The assertion that wages and prices determine unemployment is at most only right if the other factors in costs remain unaltered, or at any rate keep their relative proportions to productivity. In a stage of great shrinkage of production consequent on an economic crisis it is questionable whether the balance between costs and profits is better redressed through wages or through partial writing off of invested capital. Dr. Elsas notes that in Germany the Emergency Decree of 8th December, 1931, attempted both methods together, reducing wages and compulsorily lowering rates of interest. Compulsory reduction of interest is in its effects equivalent to writing off capital.

The dynamics of wages means a search for the optimum wage, or "that position of trade when at a given wage the largest number of persons seeking work can be employed and when the rates fixed yield the maximum real wage." Dr. Elsas notes that while it is not proved that benefit influences the amount of unemployment, the

effect of benefit on the wage optimum is considerable, for its introduction means that the worker's standpoint no longer coincides with the employer's as to what the optimum may be. H. M. L.

9.—*The Economics of Saving*. By J. Harry Jones, Professor of Economics, University of Leeds. London: Reed & Co., 1931. 7½" × 4½". xvi + 171 pp. 4s. 6d.

On the one hand, there is to-day a persistent demand that economics should be taught to the people so that they may learn to govern themselves wisely both in their personal and in their social activities. On the other hand, there is a modern school of economists, devoted to minute and abstract analysis through mathematical methods and producing conclusions couched in language so involved and so technical as to be quite incomprehensible to the ordinary reader. Perhaps it is too much to expect to return to the simplicity of Adam Smith, Ricardo, Malthus, Mill, or Marshall—a simplicity which, nevertheless, had involved hard thought and demanded from the reader close attention to its reasoning. Problems to-day are more complicated—or we think they are—and the statistical apparatus at our disposal only reveals the gaps in our knowledge. It is natural, therefore, to study economics in vacuo, to abstract or add conditions at will, to apply mathematical analysis to all possible variations of the circumstances—and to deliver the verdict that if so-and-so be thus-and-thus the conclusion may be expressed in an equation running across the page. The members of this school acclaim each other's work as admirable (even when they think it wrong) and announce or imply that they are writing not for the ignorant public but for the technically equipped. Somewhere, somehow, through more obscure channels the truth is to trickle down from those austere heights and fertilise the plans below. All this, no doubt, is wide of the mark, if the target be a review of Professor Jones's book, but one who learned his economics from economists who could write, and reason, in English may be allowed once more humbly to express his agreement with Marshall that, despite the usefulness of mathematics in analysing economic problems, "it seems doubtful whether anyone spends his time well in reading lengthy translations of economic doctrines into mathematics, that have not been made by himself."

We do not ask that economists should try to revive the childlike, yet witty and often truthful, innocence of Bastiat's fables; Professor Jones's little book will serve as a model of what we desire. It originally appeared in the form of articles in *The Building Societies' Gazette*, and a paper read in June, 1933, before the International Congress of Building Societies, has been added. There is no pretence that it is a complete statement, no smoothing over of difficulties, but, so far as it goes, it is a perfect piece of exposition. The reader will have a clear idea of what is involved in saving, in the use of capital, in public expenditure, and many other topics connected with the subject of the book. He will also gain a comprehension of what J. A. Hobson's theory of over-saving really is—this is one of the best chapters—and of the way wherein it differs from the Austrian theory of under-saving, and may perhaps get a glimpse of a possible syn-

thesis. He is even taken to the gate to see Mr. Keynes trying to solve the trade-cycle. All this is popular education of the very best kind. It is so good that one is forced to ask for more. Repeatedly Professor Jones comes up to the trade-cycle and repeatedly he turns away, protesting that this is not what he has come to talk about. That is all very well, but the trade-cycle has now got into such a mess with sine-curves and the rate of interest and investment that every wobble is treated in the United States as a fresh cycle. Who can say to-day that he knows what a trade-cycle is, how it begins, how it grows, how it perishes to be reborn again, and why? It is quite clearly Professor Jones's duty to give us a book on the trade-cycle, in which he can include some of the inner secrets of savings and investments. We shall not grumble if it is a little more difficult than this little book on Savings, for obviously he has the power to make difficulties more easy to overcome by making them clearer. H. W. M.

10.—*Cartels, Concerns and Trusts*. By Robert Liefmann. London: Methuen, 1933. 9" × 6". xxx + 380 pp. 2rs. net.

Dr. Liefmann has made a life-long study of organized industry and capitalistic structures, and the German original of this book *Kartelle, Konzerne und Trusts* is the standard work on the subject of industrial combination from the German point of view. Professor D. H. Macgregor writes an introduction for the English version, in which he attempts "to pick out some of the key ideas which may be kept in mind in following his (Dr. Liefmann's) presentation." Like many other introductions, Professor Macgregor's contribution may be equally well appreciated as an epilogue or, better still, sandwiched between a first and second reading of the book.

Practically two-thirds of the book is devoted to cartels, the general plan of the treatment being indicated by the titles of Parts I to IV, the Nature and Origin of Cartels, Effects of the Cartels on Industry, Effects of the Cartels upon the Consumer and State Regulation of the Cartels. Dr. Liefmann defines Cartels as "voluntary agreements between—or associations of—-independent enterprises of similar type to secure a monopoly of the market." By monopoly, he does not imply 100 per cent. domination, but the satisfaction of "a considerable proportion of the demand" by one single supplier or one combined group of suppliers. Having established his definition and after placing certain restrictions upon it, such as the exclusion of buyers' monopoly, the author gives a brief historical sketch of the cartel movement, turns aside to discuss the scope of the Cartels in Germany, returns to a consideration of the various forms of cartel organization, again turns aside to discuss the cartel movement outside Germany, and finally ends Part I with a chapter on the general character of present-day economic struggles. It is difficult to account for this sequence, particularly as the rest of the work appears admirably arranged. We would certainly recommend the reader to omit chapters IV and VI until he has read the remainder of Part I. He will thus obtain a clear development of the subject free from a catalogue of cartels in different countries.

The economic sequence of cartels is very well summed up by

Dr. Liefmann as follows: "To-day all sellers of goods and services have a hard struggle *with their customers over price*, whereas formerly they used to struggle *with one another* for the market, and the customer got the advantage of this struggle. This struggle has been abolished by means of cartels which are monopolistic *associations*, and thus, the struggle with the customer is to-day not one of *individuals*, but of *organizations*. The parties who used to compete with one another have joined up, but many groups of buyers have united, as we shall see, to form *their own associations*. This organized struggle between associations of sellers, above all cartels and trade unions, on the one hand, and buying organizations on the other, is the true characteristic of the present economic era."

In Part II Dr. Liefmann discusses the effects of the cartels on industry, examining in detail not only the advantages, but also the weaknesses, defects, dangers, and transient nature of some of the cartel movements. The existence of a producers' cartel, however, implies that in the opinion of the majority of the producers, the advantages to be gained by the organization outweigh the disadvantages, and the question naturally follows, what is the effect of the cartel upon the consumer? This is dealt with in Part III. Discussing the effects on the merchants, Dr. Liefmann finds that "the wholesalers, when faced with the question on which side they should throw their forces, on that of the producers who supply them, or on that of the manufacturers and retailers who are their customers, have generally chosen the former. They have taken refuge under the wings of the mighty producers' cartels and preferred to be treated as the last stage in production, rather than as the first stage in distribution." It is impossible to refer to more than one or two of the many varied aspects discussed in relation to cartels, but not the least interesting is the chapter showing the change brought about in the significance of protective tariffs by the development of cartels.

Part V is devoted to Concerns and Amalgamations, and Part VI to Trust or Monopolistic Concerns, and whereas in the early parts of the book Dr. Liefmann draws most of his illustrations from Germany, in these last two sections he draws on a much wider field, a fact which may be appreciated when it is mentioned that an index of concerns given at the end of the book contains over 600 names, all of which are mentioned in the text, and cover practically every industrial country in the world. The final chapter of the book is devoted to "The Choice—Open Competition, Private Monopoly, or State Control?" Dr. Liefmann gives us his own choice, but he has also given us enough material to make a choice of our own.

G. R. W.

11.—*Building Society Finance*. By J. L. Cohen. London: Reed and Co. 1933. 8½" × 5½". 227 pp. 12s. 6d.

As building societies assume increasing importance in the country's economic life it was to be expected that they would attract the attention of the professional economist. Mr. J. L. Cohen, who had previously worked in a more or less related field, has responded to

the stimulus. *Building Society Finance* is a notable survey of some outstanding problems of building society finance, including building societies as a part of the capital market; building society investments from the standpoint of security, marketability and yield; the ideal building society; the reactions of changes in rates of interest on building societies; and other aspects.

Mr. Cohen writes as a detached observer, though he has obviously made contacts with building society officials and assimilated much material. His book should prove a useful stimulus to discussion and is particularly welcome for the example of, and the appeal for, a spirit of scientific inquiry concerning building society problems. It is valuable for the comparison which it makes between the building society and other more or less kindred institutions and for the analysis of the societies' function in the economic structure, though one cannot help regretting that the opportunity was not seized to make a systematic review, however summary, of the machinery of finance in the housing field.

Mr. Cohen appreciates the social services which the building society movement has rendered, but this does not prevent him from being critical as, in his opinion, occasion requires. He is also in part somewhat pessimistic, but this may to some extent reflect conditions when the book was written; for while the ideal time for writing such a book may be no more than a picturesque figment of the imagination, it needs to be recognized that Mr. Cohen approached his task when the financial crisis and our departure from the gold standard were still fairly recent events. The whole economic scene—including building societies—was intensely abnormal, and Mr. Cohen's conclusions might have been more carefully qualified by reference to this fact. That he was partly misled by temporary phenomena (though admittedly it is easy to be wise after the event) is shown by the fact that the amount advanced in 1933, £103 million, easily established a new record in building society activity.

Mr. Cohen's criticisms fall, in effect, under two main heads—(1) practice and (2) future prospects. Thus under (1) Mr. Cohen is concerned by the societies' practice sometimes known as "borrowing short and lending long." He argues that the terms governing withdrawals unduly favour the investing member and do not afford the societies sufficient protection in the event of difficulties arising. Although it is doubtful whether he makes due allowance for the steady stream of incoming funds by way of repayments, progressive building society opinion shares, in the main, his view that the position needs regularizing. He forces his case to extremes, however, in saying that building society practice "is calculated to send cold shudders down the spine of any banker." A building society is *not* a bank, and to regard the two institutions as exactly comparable, and subject them to identical tests, is to ignore fundamental distinctions in practice. On the other hand, Mr. Cohen seems unable to make up his mind on the subject of liquidity, for on one page he effectively summarizes all the arguments in its favour, and on another deprecates it as a sign of weakness. There can be no doubt, however, that under existing conditions a sufficient margin of liquid assets is

one of the most trustworthy indications of prudent finance. Mr. Cohen obviously has a lively sympathy with those who would give the societies a permanent capital structure, with a Stock Exchange quotation. While some changes in capital structure may well be evolved in the future, it is extremely doubtful whether, over a long period, it would give the societies either as much flexibility or command over funds with such economy as the present system. His criticism of a negligible personal stake put into properties by borrowers is just, but this was in the main a passing phase due to the difficulties following the financial crisis and a rather more healthy condition of affairs has now been established. Indeed, recent developments of building society policy should do much to strengthen sound practice and offer a basis for further action in this direction.

It is when considering the future of building societies that Mr. Cohen is most strongly tempted to add pessimism to his criticism. His argument is developed at some length, but, put shortly, he fears that the recent expansion has been so rapid that the outlets for the societies' funds in the future are likely to be very restricted. Mr. Cohen's thesis deserves the most careful examination. It is difficult to resist the conclusion, however, that he has been excessively preoccupied by purely statistical considerations. "Saturation point" is a bogey which has been dangled by the academically-minded before many industries (notably motor-car manufacturers), but the perseverance and ingenuity of the business man have pushed this dreadful day of reckoning farther and farther away. One feels that this may well be the case with building societies, and in fact some progress has already been made in this direction since Mr. Cohen wrote. Mr. Cohen, in concentrating on the quantitative aspect of the problem, has missed the significance of the *qualitative* aspect. For our housing problem in its broadest sense, judged by reasonable standards rather than contemporary standards, is indeed formidable, and it is inconceivable that building societies will have no service to render in this task of reconstruction. Mr. Cohen ignores the tendency of much social thought and its insistence on a bold housing policy. In any case, the conclusions which he draws from his statistics are less favourable to the future of building societies than a more cautious interpretation than he attempts would warrant. It must be admitted that indefinite expansion is out of the question, but a precipitate decline in building society business seems equally improbable.

H. B.

12.—*The Rural Exodus in Germany*. International Labour Office and International Institute of Agriculture. Geneva, 1933. 9" x 6". 126 pp. + 16 tables. 3s. 6d.

This Report is the first part of a joint investigation by the bodies named above into the phenomenon known as the "rural exodus." Three areas in Germany with quite different characteristics were chosen for the enquiry in order that the rural exodus should be viewed as far as possible from all angles; Pomerania was chosen as a purely rural province with a considerable rural exodus; the Province of Saxony as a district with large industrial undertakings which

attract the rural population and promote a change of occupation; and the Free State of Saxony as providing an opportunity of studying the special conditions of home industries in country districts. The result is to give us an exhaustive and unbiassed view of the many aspects of the problem.

Some moderate migration from country districts is a necessary consequence of the high rate of natural increase in the agricultural population, of which only a proportion can usually be absorbed either in agriculture or in other rural pursuits or industries. An increase in this normal migration with a consequent decline in the rural population may be the result of the increased use of agricultural machinery, or of changes of methods of cultivation, or it may follow from a decline in rural industries. On the other hand, it may have more deeply rooted causes, such as a general dissatisfaction with rural conditions, and it may vary very much in intensity. In parts of Germany, for example, the migration, particularly from 1925 to 1929, assumed serious proportions and led to an acute shortage of agricultural labour and other difficulties.

Examination of all the circumstances leads to the conclusion that the true causes of the rural exodus are to be found in the inequality of conditions as between urban and rural occupations, and in the differences in the standard of living in town and country. So far as the agricultural worker is concerned the disadvantages have often been pointed out, both in Germany and elsewhere: wages are lower, there are fewer chances of improvement in position, the hours are long and irregular, while housing conditions may be unsatisfactory. Another reason, which is interesting because it may have a bearing on the decrease in the number of agricultural labourers which has taken place in England, is that unemployment insurance in Germany is less favourable to agricultural than to industrial workers, and has thus acted as an inducement to them to change their occupations. Similar considerations also influence other rural workers and members of peasant families who see few advantages in country life. Broadly speaking, until quite recently, economic conditions in towns have held out the promise of a standard of life which has been unattainable in the country.

Since 1930, however, the prevalence of urban unemployment has revolutionized the position. Rural migration has been replaced by a movement from the towns so that in rural districts in Germany there is now a surplus of labour, which is made more acute by the fact that reasons of economy have compelled employers to reduce their labour staff. What is likely to be the duration of this change it is impossible to say, but the writers of the Report consider that the movement to leave the towns for the country is not due to economic causes alone, but has also a psychological origin. "The present generation," they say, "especially the young, whose experience of the seamy side of modern economic evolution is other and more bitter than that of the preceding generation, is inspired by an idealism which inevitably produces a longing for a simpler life closer to nature." In any case, the temporary cessation of the rural exodus and the appearance of a new attitude to country life do not provide

a permanent solution of the problem. If the present depression is overcome, the difference between urban and rural economic conditions will again, it is thought, exercise a great attraction for country people unless presumably some greater measure of economic equality is achieved in the meantime.

The Report reviews the various measures adopted or proposed to combat the rural exodus, such as the improvement in the economic situation of agriculture, land settlement, and the betterment of the general conditions of country life.

R. J. T.

13.—*The Tariff on Sugar*. By Lippert S. Ellis. The Rawleigh Foundation, Freeport, Ill., U.S.A. 1933. 190 pp. *The Tariff on Dairy Products*. By Roland R. Renne, Ph.D. 176 pp., and *The Tariff on Barley, Oats and Corn*. By Theo. W. Schultz. 116 pp. Published by the Tariff Research Committee, Madison, Wisconsin, 1933. 9" x 6". 50 cents each.

During recent years, a favourite nostrum in the United States for remedying agricultural depression has been the advocacy of an increase in the duties on agricultural products, and so strong is the belief in the tariff, especially among farmers, that politicians, even when aware that additional duties can have little or no effect, generally hesitate to criticize such proposals for fear of offending their constituents. In fact, in regard to the tariff generally, there is much propaganda but little dispassionate analysis. These three publications endeavour to make good this defect by studying separately some of the principal agricultural products and attempting to assess the effectiveness of the tariff and to measure the costs and benefits to consumers and producers. The results are of interest not only as regards the United States but also as illustrations of the tariff problem as a whole. The monograph on sugar covers the widest field because the sugar situation in the United States cannot be considered apart from conditions prevailing in the world market, while many of the conclusions are applicable in principle to sugar-producing countries generally.

The price situation of each of the products is carefully studied in order to determine how far the tariff has affected prices in the United States compared with prices in free markets, and it is interesting to notice that the three groups of commodities provide examples of the varying ways in which a tariff may operate. In the case of sugar, it is considered that prices to the consumer are raised by the full amount of the duty, with consequential benefits to the growers and refiners of sugar both in the United States and in the Philippines and other American possessions. Leaving the latter out of account, the duty assists only about 2.3 per cent. of American farmers, while it taxes the entire farm population (as consumers) more than the amount of benefit to this small group.

In the case of barley, oats and maize, on the other hand, the tariff is considered to have practically no effect on prices, although this view is apparently contrary to current opinion in the United States and the duties have been progressively raised. In the dairy group, the conclusion is that while the duties on different

products vary in their effects, they are on the whole of some benefit to the farmer, largely by creating a domestic market independent of the world market.

R. J. T.

14.—*Communications in the Far East.* By Frederick Vincent de Fellner, D.Sc.Econ., Professor's Assistant in the University of Budapest (Faculty of Economics.) London: P. S. King and Son, Ltd. 1934. 8½" × 5½". vi + 362 pp. 15s. net.

When in September, 1930, the nineteenth session of the International Statistical Institute was held at Tokyo, Professor Frederick de Fellner, of the Budapest University, a member of the Institute, was accompanied thither by his son, Dr. F. V. de Fellner, who remained afterwards to make an intensive study of communications in the Far East. The results of this study, and of an examination of all available literature on the subject, are given now in the work under review, an excellent English translation from the original Hungarian.

Under the designation "Far East," the author includes China, Japan, the Japanese Possessions and the territories within the Japanese spheres of interest; he has also a brief chapter on communications in Siam.

The work is essentially a description of the economic conditions of Japan and China, as exemplified by the present state of their communications with each other and with the rest of the world. It is divided into three parts, consisting of: I. A general introduction discussing the existing natural and economic conditions of the Far East and the present state of goods and passenger traffic between the Far East and other parts of the world. II. The present position of the various branches of communication in the Far East, viz., the railways of Japan, Korea, Manchuria and China; the maritime shipping of Japan and China; inland river navigation; foreign maritime shipping; roads; motoring; and aerial transport; post, telegraph, wireless telegraphs and telephones; urban communications and communications in Siam. III. Means of communication between the Far East and other parts of the world, viz., shipping lines between the Far East and America; communications with Australia; the maritime routes between the Far East and Europe and Africa; the Trans-Siberian and the Pacific railways; telegraph, cable and radio communications; and lastly a forecast of future developments. Thus, the scope of the work is truly comprehensive.

The author describes clearly and with abundant statistical detail the immense development which has occurred during recent years, and especially since the War, in the industrial and trading activities of the Japanese Empire. As a direct consequence of the War, and also of the part taken by the United States in the rehabilitation of the areas devastated by the great Japanese earthquake and fires of September, 1923, a great trade across the Pacific ocean has been established between America and Japan, in connection with which the Panama canal is an exceedingly important factor. The author even goes so far as to make an assertion (which perhaps is open to question) "that the centre of gravity of the economic forces

of the world has shifted from Europe to America and Asia and from the Atlantic to the Pacific ocean."

Facts and figures given demonstrate abundantly the extraordinary powers of organization possessed by the Japanese people, who in the comparatively brief period of fifty or sixty years, have adopted, adapted and developed methods of organization and industrialization to which the Western countries have attained only after many generations of struggle and effort. When travelling to Japan in 1930 by a Japanese liner, the writer was particularly impressed with the efficiency of the arrangements made for the convenience and comfort of a large number of passengers, including both Orientals and Europeans, and also by the punctuality of the arrivals at the ports and at the ultimate Japanese destination, in accordance with the pre-arranged time schedule.

Dr. de Fellner's work shows how in every department of national activity Japan has come to the front as the equal of Western nations and as a serious competitor with them for the world's trade. There are of course great contrasts between oriental and western conditions, and yet noteworthy parallels may be drawn between Great Britain, the ancient island power of the West, and Japan, the modern island power of the East. Tokyo, intersected by the winding river Sumido, spanned with numerous bridges, like another Thames, containing an ancient imperial demesne, which at least preserves amidst urban surroundings a valuable breathing space, and with differing climatic conditions due to variety of altitude and situation, has also like London both suffered and benefited from its great fire. The city, crowded with narrow streets and small wooden buildings, which in 1923 witnessed the terrible holocaust of victims hopelessly entrapped, is now replanned upon a magnificent scale, with wide streets, stone buildings and the latest improvements copied from the leading cities of the world. The same can be said of Yokohama, the seaport where new docks and wharves serve admirably the increasing requirements of the foreign trade of Japan. How this trade has expanded during the last forty years, Dr. de Fellner shows by tables of imports and exports from which it appears that the increase in the value of imports into Japan from the United States and from countries of the British Empire as between 1890 and 1928 was as follows: United States £690,000 to £62,550,000; Canada £100,000 (1906) to £6,650,000; Great Britain £2,660,000 to £16,485,000; Australia £33,400 to £13,050,000; and British India £6,031,500 to £28,550,000. Exports from Japan increased during the same period as follows: United States £2,084,400 to £82,600,000; Canada £395,000 (1906) to £2,700,000; Great Britain £560,000 to £5,890,000; Australia £79,500 to £4,300,000; and British India £1,035,000 (1906) to £14,600,000. The corresponding figures for 1931 show a great drop as a consequence of the general economic depression.

As regards China, an opposite condition of things prevails. The exact area and population of this vast country are to a great extent conjectural, and this is reflected in the figures given by the author, who without counting territories connected with it by political bonds of loose kind, gives the area of China as 6,420,000 sq. kilometres, or

2,479,000 sq. miles, and the population as 450 millions. There is apparently some miscalculation here, as the estimate placed before the International Statistical Institute in 1930 by Mr. Warren H. Chen gave "the probable population of all China" as in the "neighbourhood of 445 millions for the year 1929 and the total area as 4,278,000 sq. miles. But in any case, as the author points out, the standard of life of the overwhelming part of the Chinese population is so low that it cannot at present, nor perhaps for a long time to come, represent any large body of purchasers and consumers of the products of other lands. Moreover, the prevalence of civil war, brigandage and other symptoms of chronic disorder prevent development of the resources of a country that otherwise possesses immense potentialities. The author points out the great advantages China has in its system of inland waterways, which are so extensive that practically all parts of the country are accessible by this, the cheapest means of transport.

Very deplorable is the condition of the Chinese railways. Their total length is given for 1932 as 15,000 kilometres, or 9320 miles; but it is stated that the permanent way and superstructures of the State railways are as bad as possible, whilst their financial situation "has not permitted even the most important replacements and improvements to be systematically effected." According to an estimate quoted, the reorganization of these railways and the replacement of material would require a sum of 76,850,000 Mexican dollars, or £7,685,000.

Of much interest are the chapters devoted to description of the maritime routes between the Far East and western countries, to the respective advantages of the Suez and Panama canals and to the ultimate prospects of the Trans-Siberian railway, which, when opened for through goods traffic, is, in the author's view, bound to affect very considerably the present maritime rates and conditions.

The work as a whole cannot fail to be of great value to all who are interested in the Far East. A useful feature is the statement of "literature used" which is appended to each chapter, and there is a good alphabetical index. A map of the Far East might, however, have usefully been included.

Here and there are statements which may be considered as open to criticism, as for instance where the author expresses opinions which may not find general acceptance. Thus at the beginning of his chapter on the railways of Manchuria the author writes: "No doubt the independent republic of Manchuria designates merely a transitory condition between the colonisation of Manchuria by Japan and its probable future definite annexation by that country."

Again, he stresses the economic effects of the Indian boycott and unrest, which were at their height when the book was being written, but have since almost entirely subsided. The fact is that more depends upon securing the goodwill of Oriental peoples by square dealing and good faith than perhaps is generally recognized. It was stated to the writer during his voyage to the East by an intelligent young Chinese doctor, educated in Great Britain: "If you can secure the goodwill of the Chinese people—and he intimated that the

restoration to China of Wei-hei-Wei was a step in this direction—your unemployment problem will be solved.” E. H. G.

15.—Other New Publications.*

Brookings Institution. Institute of Economics. The A.B.C. of the N.R.A. Washington: Brookings Institution, 1934. 8 $\frac{1}{4}$ " \times 5 $\frac{1}{2}$ ". xiv + 185 pp. \$5.

[This is the second study issued by the Brookings Institution dealing with the recovery programme of President Roosevelt. To quote from the Director's preface: "So energetic has been the execution of the N.R.A. programme and so quickly changing the aspects which have been brought to the public's attention that it has been difficult, if not impossible, even for interested persons, to see the significance of the law as a whole or to observe its administration with proper perspective." This book is intended to explain the background and scope of the Act and to describe its administration in a simple and understandable form. The President's Re-employment Agreement, and the code-making process with its administration and enforcement are discussed in some detail, and the text of the different legislative documents with sample codes and code provisions are given in the appendices.]

International Labour Office. Studies and Reports, Series C (Employment and Unemployment), No. 18. Employment Exchanges. An international study of placing activities. Geneva (London: P. S. King), 1933. 9 $\frac{1}{2}$ " \times 6". iv + 231 pp. 5s.

["To organize placing work is to organize the labour market, and a good organization of the labour market is one of the cornerstones of a general economic organization." Since profit-making employment agencies were denounced by the International Labour Conference in 1919, the placing of work has gradually been taken out of their hands and is now dealt with almost entirely by a public employment service. It is with this latter form of agency that the present work is concerned. The book is made up of six chapters, as follows:—1. The General Organization of Employment Exchanges (their relations with private agencies and with employers and workers, and the recruitment of the staff). 2. Specialization by Occupation and Sex (which surveys under eight groups the special problems involved in securing employment). 3. Occupation Changes (describing training schemes and other methods of promoting mobility of labour, and also the dovetailing of seasonal employment). 4. Labour Clearing (its general technique and procedure). 5. International Placing (including the various forms of migration, and the machinery for organized recruiting and placing). 6. Statistics of the Operations of Employment Exchanges. The introduction contains some interesting statistical tables; there is also a bibliography of official and non-official publications dealing with the subject in the principal countries of the world, and an appendix.]

International Labour Office. Studies and Reports, Series M (Social Insurance), No. 11. International Survey of Social Services. Geneva (London: P. S. King), 1933. 9 $\frac{3}{4}$ " \times 6". xxiii + 688 pp. 15s.

[Twenty-four countries are studied and the information is given under six heads: Statistics of Population, Social Insurance, Social Assistance, Housing, Family Allowances, and Holidays with Pay. The work is the outcome of a request made to the International Labour Office by the British Government in 1926. The Office consulted certain members

* See also "Additions to Library," pp. 536 *et seq.*

of the Correspondence Committee on Social Insurance and, as a result of their report, appointed a committee from among its own members to enquire into social charges, keeping to the requirements of the British Minister of Labour as far as possible. The reports and proposals of this Committee, which led to the publication of the survey in its present form, are given briefly in the introduction. The term "social services" is taken to include only those services designed to cover one of the following risks: industrial accidents, occupational diseases, sickness, maternity, invalidity, old age, involuntary unemployment, and family responsibilities, and established "on behalf of classes of the population consisting mainly of wage-earners and persons of small means working on their own account." Because of the delay in the publication of the official national reports in many countries, the summary of legislation and the statistics given in the national monographs relate to the year 1930, or, in a few cases, to the financial year 1930-31. Attention is drawn to the fact that since that time changes have been effected in several social services. The Committee have recommended, however, that a second edition, relating to 1933, should be prepared, and, if possible, published some time in 1935. The book as a whole constitutes a valuable record of what has been done in the way of social assurance and poor relief in the principal countries of the world.]

Kingsbury (Susan M.), assisted by *Fairchild (Mildred)*. Employment and Unemployment in Soviet Russia. Report submitted to the World Economic Congress, Amsterdam, August 23-29, 1931. Advance print taken from Final Congress Publications issued by the International Industrial Relations Association, the Hague. New York: Office of the Vice-President. 9½" × 6½". 132 pp.

[Russia was one of several countries (the others being Australia, Canada, France, Germany, Great Britain, and the United States) considered to afford first-hand data for a comparative study of the economic crisis in 1931, and therefore invited to submit reports to the Congress. The present volume forms one of a series of these reports, dealing with Social Economic Planning in the U.S.S.R. Its object is "to reveal the status of employment and unemployment in Soviet Russia and to consider their causes and significance." It includes figures of population, production, productivity of the worker, wages, and standards of living. The data available cover the years 1913-1930, and are here published in English for the first time. The book contains a number of tables and charts, also appendices giving the sources of data, indices used in the Report, and a programme of the 1931 Congress.]

Lorge (Irving), under the direction of *Edmund de S. Brunner*. American Villages: 1930. An analysis of census data. New York, Columbia University: American Statistical Association, 1933. 9" × 6". iii + 133 pp. \$1.

[A similar compilation, based on the 1920 census, was made in 1925 by Dr. C. Luther Fry, who was a pioneer in this field and incidentally laid the foundation for an intensive study of American agricultural villages by means of selected samples. In the present study, based on the 1931 census, the same 177 "representative agricultural incorporated villages that are farmers' service stations" have been taken. As the author points out, "the publication of the 1930 returns for identical villages gains much in value because of the accessibility of the 1920 data. Comparisons are possible; trends may be inferred; and by judicious interpretation, predictions may be hazarded." The statistics given are of sex and age distributions, race, immigration, marital conditions, education, and employment, and the tables are divided into four geographical groups, the Middle Atlantic States, the South, the Middle West, and the

Far West. There is a national summary which gives comparative percentages of the 1920 and 1930 data for villages by regions and for the United States as a whole. The book consists entirely of tables except for some prefatory matter, four pages of introductory comment, and a short explanatory note at the beginning of each tabular group.]

Mehta (J. K.). The Value, Classifications and Principles of Public Revenue and Expenditure. Allahabad: Indian Press, Ltd., 1933. 7½" × 5". iv + 58 pp.

[A short critical study of the prevailing principles of public finance, with a comment on what the author considers to be their unsatisfactory nature in certain respects, and suggestions for a new classification on more scientific lines and in accordance with the "true objects of the State."]

Robertson (C. J.). World Sugar Production and Consumption. An economic-geographical survey. With a foreword by Noel Deerr. London: John Bale, Sons, and Danielsson, 1934. 5s.

[In spite of the many books which have been written on sugar production no survey appears to have been made of its economic-geographical aspects. The author, in his capacity of lecturer on the Sugar Trade at the City of London College, has felt this need and has attempted to meet it in the present work. The book opens with an outline of the world's sugar trade, and the general conditions of cane and beet sugar production in relation to climate, soils, labour, and factory. To avoid repetition certain facts common to all the producing countries are set forth in two general chapters dealing with the industry as a whole and under present conditions. Then follow chapters on the principal cane-sugar producing countries (Cuba, Java, India, other Empire countries, the United States, and the Philippines), and on the beet-sugar countries of Europe, including the Soviet Union. The refining industry is reviewed briefly but adequately. The component factors of consumption, and the prospects of consumption and production are dealt with at some length. Some interesting facts are brought out in the statistics of consumption per head in the countries for which data are available. Australia has the highest rate, 59 kilos, apparently because of the excessive drinking of very strong tea there. America is second with 51 kilos. This is attributed to the greater consumption of sweets and soft drinks while prohibition was in force. The others coming into this high-rate group are the English-speaking countries, Scandinavia, and Switzerland, the reason being probably their low taxation on sugar. The author shows that sugar consumption is usually greater in towns than in rural districts, that it is influenced by the extent to which it is taxed, and by money income. He emphasizes the need for better statistics of sugar consumption in general. There is a short bibliography and an index.]

Shanghai Bureau of Social Affairs. Strikes and lock-outs in Shanghai since 1918. Shanghai, 1933. 10½" × 7½". xi + 115 + 179 pp. \$5.00.

[Facts and figures which have appeared in previous reports published by the Bureau on the same investigation have here been revised, and scattered data relating to the last fifteen years collected and incorporated. The text, printed in English as well as in Chinese, consists of an Introduction; a sketch of labour movements, political upheavals, legislative changes, and the growth of labour organizations; an Analysis of the Data; and a Summary and Conclusion in the course of which we are told that the industrial system is built "on motives of greed and fear" and that the only remedy for the present unrest is to substitute "the motive of public service, the motive to work and produce for the com-

munity as a whole," and to this end to create "a new working class who are conscientious, self-assertive, and aware of their own position and importance." The low wage-rates which prevail have been the cause of many of the stoppages (one enquiry undertaken by the Bureau into the standard of living of labourers in Shanghai showed that of 305 families under investigation each had an annual deficit of \$37.87 after balancing average incomes with expenditure). Since 1926, however, the questions of collective agreement and the engagement or dismissal of workers have become almost as important as that of wages. The textile industries have been most affected by strikes and lock-outs; in the last six years four million dollars' worth of wages were lost. Although most of the disputes occurred in Chinese establishments, the Japanese and British were not entirely free from them. The thirty tables and charts are also in both languages. An appendix, occupying more than half the book, is in Chinese only.]

Stamp (L. Dudley) and Beaver (Stanley H.). The British Isles: a geographical and economic survey. With contributions by Sir Josiah Stamp and D. K. Smee. London: Longmans, 1933. 9" x 5½". xii + 719 pp. 25s.

[This survey is based on original researches made by the authors and others under their guidance during the past four years. The scope of the book is wide, since an endeavour has been made to take stock of all the natural resources of these islands, their past and present utilization, and their future possibilities. In this connection many comparisons are made between pre-war and post-war years and note is taken of the changed conditions brought about by developments in other countries during and since the war. There are chapters on the physiography, climate, soils, vegetation, and forestry of the British Isles. The agricultural chapters include a short history of farming, its present trends and characteristics, agricultural output, and the distribution of live-stock; also special notes on certain agricultural industries (sugar-beet, canning, brewing, and distilling). A third of the book is devoted to major industries—fisheries, iron and steel, non-ferrous metals, textiles, chemicals, and coal and other mining industries. The peopling of the country, the present distribution of the population, the growth of towns and the influences of communications are also studied. London has a chapter to itself; others deal with the industrial regions and the commerce and ports of Ireland. A chapter on the British seaports discusses the concentration of trade in a few major ports and the geographical and economic factors responsible for this. The concluding chapter, on the national income, has been contributed by Sir Josiah Stamp. There are numerous statistical tables, diagrams and illustrations, short bibliographies after each chapter, and an index. The book is a marvel of compactness and should be of immense value to anyone interested in economic geography.]

Wattal (P. K.). The Population Problem in India. A Census Study. Bombay: Bennett, Coleman & Co., 1934. 7½" x 5". xii + 185 pp. Rs. 3.8.

[The first edition of this book was issued in 1916 and was reviewed in the *Journal* for January, 1917. At the present day a greater interest is taken in the census in India. That for 1931 covers a wider field than did those of earlier years, and its reports are more informative. For these reasons the present edition of this book, based on the 1931 census, has been rewritten and enlarged. Chapters have been added on Births and Deaths, Differential Fertility, and Birth Control. It is the author's conviction that biological problems in India are not given enough attention, and that "there is far too much suffering and misery around us which it is within our power to avoid." He urges the appointment of a Commission, similar to that recently set up in Japan, to consider

such questions, and to present to the public a comprehensive survey of the position and recommendations for its improvement. In his view the facts this Commission would have to face are that Indian vital statistics are far from perfect; that there is a much higher death-rate in India than in most civilized countries; that the rates of infant mortality and maternal mortality are excessively high; that the average expectation of life at birth is half what it should be; and that the health of the people is unsatisfactory and their nutrition poor. It is to be regretted that the book has no index.]

CURRENT NOTES.

On page 517 we give our usual table summarizing the overseas trade of the United Kingdom for the years ended May, 1933 and 1934. The excess of imports over exports of merchandise during the first five months of this year was £118·9 million, or £18·7 million more than in the corresponding period of 1933. The import excess for the twelve months ended May was £278 million, which compares with £259 million in the year 1933 and £286 million in 1932. For the twelve months ended May, the increase in total imports compared with the preceding twelve months was 6·6 per cent. and the increase in total exports 7·9 per cent.

Total imports, exports of United Kingdom goods, re-exports, and goods transhipped under bond were all greater in value in the first five months of this year than a year earlier, the respective increases being 13, 7, 24 and 7 per cent. To some extent the increase, particularly as regards re-exports, was due to a rise in average values—for the first quarter of the year imports, exports and re-exports were respectively 4, 0·5 and 14 per cent. higher in average value than a year earlier. The increase in average values was very marked in respect of meat, tea, wool, hides and skins, leather, rubber and non-ferrous metals. The volume of retained imports and of exports of United Kingdom goods was higher by 12 and 5 per cent., respectively, than in the first quarter of 1933. The increase in imports applied to all but six of the 43 groups comprising the three main classes. Among industrial materials and manufactures there were only two declines, viz., hides and skins and rubber manufactures. The increase in exports was not so general as regards food, drink and tobacco and raw materials, but in respect of manufactures all the groups except coke and cotton yarns and manufactures showed increases compared with the first quarter of last year.

The value of the total imports during May was £61,727,000 being an increase of £4,451,000 on the total for May, 1933. The increase would doubtless have been greater but for May this year being one working day shorter than a year earlier owing to the incidence of the Whitsun holiday. Imports of food, drink and tobacco declined slightly, but imports of both raw materials and manufactured articles increased in value by over £2 million. Re-exports show similar movements as regards the main classes, the total value during the month being £4,787,000, or £967,000 more than in May, 1933.

Retained imports of food, drink and tobacco during May were valued at £28,485,000, which was smaller by £281,000 than a year earlier. Imports of dairy produce were substantially greater in quantity, the value increasing by over £550,000. Grain and flour showed a decline of about £450,000 in value, the aggregate quantity remaining about the same. As in previous months, however, imports of wheat and oats declined and imports of maize and barley increased. The value of the retained imports of meat was practically unchanged, but there were reduced imports of bacon and mutton and lamb, and increases in average values of all the principal descriptions of meat. Tea, as in earlier months this year, was imported in smaller quantities, and for the five months retained imports declined in quantity by 20 per cent., but rose in value by nearly £900,000 (12 per cent.) For the month of May only there was a substantial decline in imports of raw sugar.

Retained imports of raw materials were valued at £14,196,000, or 12 per cent. more than in May, 1933, while for the five months there was an increase of £18·1 million (31 per cent.). To some extent this increase was due to enhanced prices, but there were important increases in the quantities of many of the principal raw materials imported and retained. There was a particularly striking increase of £4·0 million (72 per cent.) in wood and timber, presumably connected with increased activity in building and also in coal mining, since pit props have shared the general increase in the quantities imported. Retained imports of raw wool have increased in value by a similar amount, but the quantity of raw sheep's and lambs' wool declined by 10 per cent., owing to very small imports in May. Cotton and other textile raw materials, rubber, iron ore, tin and other non-ferrous ores, and wood pulp have all been imported this year in largely increased quantities.

The increase in retained imports of manufactured articles was £2·2 million in May and £10·8 million in the five months ended May, the increase approaching 20 per cent. Non-ferrous metals, iron and steel, and machinery showed the largest increases, the three groups accounting for roughly 45 per cent. of the total increase in value. Other groups showing large increases in the value of retained imports were the miscellaneous group and chemicals, drugs, etc. Imports of refined petroleum continue to be greater in quantity but less in value than a year ago. Newsprint, which early in the year was imported in smaller quantities than last year, has subsequently more than made up the deficiency.

Movements and Classes.	Twelve Months ended 31st May, 1933.		Twelve Months ended 31st May, 1934.		Increase (+) or Decrease (-).	
Imports, c.i.f.—	£'000.		£'000.		£'000.	
Food, drink and tobacco	356,516		341,380		(-) 15,136	
Raw materials and articles mainly un-manufactured	158,459		202,158		(+) 43,699	
Articles wholly or mainly manufac-tured	146,671		162,492		(+) 15,821	
Other articles	4,122		4,003		(-) 119	
Total Imports ...	665,768		710,033		(+) 44,265	
Exports, f.o.b.—						
<i>United Kingdom Produce and Manufactures—</i>						
Food, drink and tobacco	28,958		29,095		(+) 137	
Raw materials and articles mainly un-manufactured	43,787		47,806		(+) 4,019	
Articles wholly or mainly manufac-tured	269,130		288,761		(+) 19,631	
Other articles	12,705		12,493		(-) 212	
<i>Imported Merchandise—</i>						
Food, drink and tobacco	12,581		12,590		(+) 9	
Raw materials and articles mainly un-manufactured	22,672		29,323		(+) 6,651	
Articles wholly or mainly manufac-tured	10,277		11,702		(+) 1,425	
Other articles	277		229		(-) 48	
Total Exports ...	400,387		431,999		(+) 31,612	
Bullion and Specie—						
Imports	187,049		343,996		(+) 156,947	
Exports	116,841		118,616		(+) 1,775	
Movements of Shipping in the Foreign Trade—	Number of Vessels.	Thousand Net Tons.	Number of Vessels.	Thousand Net Tons.	Number of Vessels.	Thousand Net Tons.
<i>Entered with cargoes—</i>						
British	23,783	35,121	23,876	35,838	(+) 93	(+) 717
Foreign	22,208	23,967	24,551	25,846	(+) 2,343	(+) 1,879
Total entered ...	45,991	59,088	48,427	61,684	(+) 2,436	(+) 2,596
<i>Cleared with cargoes—</i>						
British	30,298	33,932	28,803	33,944	(-) 1,495	(+) 12
Foreign	19,263	21,092	20,739	21,987	(+) 1,476	(+) 895
Total cleared ...	49,561	55,024	49,542	55,931	(-) 19	(+) 907

As in the early months of last year, British exports this year have shown a definite expansion, the average for January and February being £30·8 million and for March and April £31·6 million, while for May a total of £32·8 million was recorded, representing an increase of £2·0 million ($6\frac{1}{2}$ per cent.) on the total for May, 1933. Exports of food, drink and tobacco during May were valued at £2,397,000, being 11 per cent. more than in May, 1933, due mainly to increased exports of spirits to the United States. Raw materials exported in May were valued at £4,325,000, or $3\frac{1}{2}$ per cent. more than a year ago, notwithstanding a decline in the value of the coal exported. The principal increase was in respect of raw wool, wool waste, etc., and for the five months the increase in value of these exports was £1,335,000 while in quantity British exports of sheep's and lambs' wool increased by nearly 36 per cent. The quantity of coal exported in May decreased by 22,500 tons, or less than one per cent. The various countries with which trade agreements have been concluded took coal in increased quantities, the major increase being in exports to Germany, 72,000 tons or 40 per cent. The quantity exported to our two largest markets for coal, France and Italy, was smaller by 16 per cent. in each case.

Exports of manufactured articles were £1,569,000 more than in May, 1933; all except four of the 20 groups showed increases and in respect of both woollen and worsted yarns and manufactures and machinery the increase was nearly £500,000. The value of iron and steel goods, and of chemicals, drugs, etc., exported increased in each case by about £220,000, manufactures of textile materials other than cotton, wool and silk by £176,000 and non-ferrous metals by £146,000. There were heavy declines in respect of vehicles (£322,000) and cotton yarns and manufactures (£137,000), due in the former case to exports of locomotives and ships during May this year being very small.

The decline in exports of iron and steel goods since 1931 was practically made good this year, the figures for the first five months of 1931, 1932, 1933 and 1934 being 837,000, 805,000, 751,000 and 833,000 tons, respectively. Exports during May were relatively high, 191,000 tons, the increase being mainly in finished goods, among which railway material and wrought tubes may be mentioned in particular. The tonnage of machinery exported in May was nearly 25 per cent. more than a year ago, thus continuing the expansion recorded for earlier months. The increase was principally in textile machinery. Exports of motor cars were also higher than last year, in May as well as in earlier months, but there was a decline in motor cycles.

The quantity of cotton yarns exported has shown some increase this year, but in respect of cotton piece goods the decline continues, exports being 121 million square yards (13 per cent.) less than in the first five months of last year and 143 million less than a year earlier. Exports to India and to British West Africa declined in each case by 30 million square yards, while to China and Hong Kong there was a reduction of 25 million. Exports to Canada at 30 million square yards were much higher than in previous years, being nearly double those in 1933. Wool tops, woollen and worsted yarns and woollen and worsted tissues have all been exported in substantially greater quantities this year than last, and there has also been an expansion in exports of linen piece-goods. Exports of artificial silk piece-goods, though somewhat less than a year ago, differed little from those in the first five months of 1932.

There was some slackening after March in the very heavy movement of gold bullion and specie into and out of this country resulting from the adoption of a gold bullion standard by the United States in January. Imports during the first quarter of the year amounted to £148.7 million and exports to £77.6 million, of which all but £4.6 million went to the United States. In both April and May imports were between £14 million and £15 million and exports about £8 million. The excess of imports over exports of gold during the first five months of the year was £84.3 million. In 1933 the accumulation of gold in this country amounted to £191.3 million, and that accumulation is still continuing.

During the three months April-June, 1934, general wholesale prices as measured by the Board of Trade index-number showed little change, a slight fall during April and May being followed by an advance in June, and the index-number which stood at 87.0 in March had returned to 86.8 in June, the numbers for the intervening months being 86.2 and 85.8 (1930 = 10.0). Over the period, however, the wholesale prices of most articles of food rose appreciably (2.8 per cent.) and the prices of materials fell 1.8 per cent. The fall in the prices of materials has been fairly general, the only important exceptions being iron and steel and rubber. In iron and steel the rise has been slight, being a continuation of the small but steady increases during the last twelve months. The prices of rubber, however, have advanced rapidly during the period and at the end of June were practically double those obtaining in September, 1933. The rise in the latter is due, no doubt, to the agreement to reduce production. The most noticeable fall in materials was in wool, which has been declining in price since January and in June had

fallen 12 per cent. since March and 15 per cent. since January, 1934. The fall in coal prices since March (4·7 per cent.) is principally seasonal. The rise in the index-number for food prices during the last three months is due principally to advances in cereals owing to adverse crop reports following on the general drought. There have also been increases in fresh meat prices, while bacon prices fully maintain their high level. Tea prices fell somewhat during the period but are far in advance of those ruling twelve months ago. Appreciable increases are also shown in the prices of raw cocoa, coffee, sugar and even of New Zealand butter, which had been at a very low level for several months. It is probable, moreover, that food prices in general will record still further advances in the near future. Wholesale prices of food were, in the last week of June, still nearly 5 per cent. below the level of the period immediately preceding 19 September, 1931, when the gold standard ceased to govern currency issues. The prices of materials are slightly more than 10 per cent. higher.

The index-numbers (1930 = 100) of wholesale prices as calculated at the Board of Trade are given below for the last four months.

Month.	Total Food.	Total not Food.	All Articles.
March, 1934	79·6	91·3	87·0
April, 1934	78·5	90·7	86·2
May, 1934	78·9	89·8	85·8
June, 1934	81·8	89·7	86·8
June, 1933	81·8	87·0	85·1
June, 1932	87·8	79·1	82·0

Compared with prices ruling in 1913 both articles of food and materials show an advance on balance of about 3·6 per cent. Compared with 1924 both groups declined about 37½ per cent.

The *Economist* index-number shows little change on balance during the period April to June, advances in the prices of cereals being counteracted by reductions in those of textiles and coal. At 20 June, 1934, the general number (1927 = 100) stood at 65·3 compared with 65·4 at the end of March and at practically the same figure in each fortnight of the intervening period. At the end of June, 1933, the index-number was 65·0.

A similar stationariness of general prices is shown by the index-number published in the *Statist*, although a rather more decided advance is indicated in the prices of articles of vegetable food. The general number (1866-77 = 100) for April, 1934, was 81·0; for May 81·1, and for June 80·7.

The British index-numbers of wholesale prices and those for France, Germany and the United States are set out below for recent months.

	Board of Trade (1913=100).	<i>Economist</i> (1913=100)	<i>Statist</i> (1866-77 = 100).	U.S.A. (Bureau of Labour) (1913=100)	France (<i>Stat. Gén.</i>) (1913=100).	Germany (<i>Stat. Reichamt</i>) (1913=100).
March, 1934	103.8	90.0	82.2	105.6	380	95.9
April, 1934 ...	102.8	90.0	81.0	105.0	378	95.8
May, 1934 ...	102.4	90.0	81.1	105.6	372	96.2
June, 1934 ...	103.6	89.9	80.7	—	363	—
June, 1933 ...	101.7	89.5	81.3	93.1	396	92.9

Shipping freights continue low and have declined during the last six months. In June, 1934, the rates were also less than those prevailing in June, 1933. The index-number of freights (1920 = 100) prepared by the Chamber of Shipping for April, May and June were 17.69, 17.89 and 17.22 respectively, showing a fall in June of 5.7 per cent. as compared with March, 1934, and of 4.9 per cent. compared with June, 1933. Some improvement took place in the rates for the Argentine and Canada both as compared with May, 1934, and June, 1933, but the prospects of any general improvement are small, having regard to the large amount of surplus tonnage.

The appreciation in the value of Stock Exchange Securities, which has been more or less continuous since the middle of 1932, was arrested in May and June both as regards Fixed Interest Stocks and Variable Dividend Securities. The index-number of Stock Exchange Values published in the *Banker's Magazine* stood at 121.8 on 19 June, 1934 (Dec. 1921 = 100), compared with 122.6 and 123.8 at the middle of May and April respectively. The decline was common to both variable and fixed interest stocks, but was slightly greater in the former class. The most notable falling off was in the prices of British ordinary Railway Stocks, although there was some decline also in their Preference Stocks and Debentures, due no doubt to some apprehension of the effect of the wages agitation among the employees of the Companies. On the other hand, United States Railway Shares have shown some tendency to improve. A slight set-back is apparent in many classes of industrial and commercial securities.

The index-numbers for the period March to June, 1934, are given below (prices at Dec. 1921 = 100).

Date.	Fixed Interest Stocks.	Variable Dividend Securities.	Total.
19 March, 1934	126.2	116.2	122.9
18 April, 1934	126.9	117.3	123.8
18 May, 1934 '	125.8	115.9	122.6
19 June, 1934	125.3	114.5	121.8
17 June, 1933 ...	118.7	105.1	114.3

The continuous fall in general food prices which started at the beginning of February, 1934, was arrested at the beginning of June, when the monthly index-number of food prices (July 1914 = 100) prepared in the Ministry of Labour stood at 117. It was at 116 at 1 May and 124 at 1 January, 1934. A considerable portion of the fall over the period was seasonal. On the other hand, there has been a rise in the prices of mutton (both British and frozen), and the prices of tea and bacon have continued to advance, with the result that on balance food prices at 1 June, 1934, were about 2 $\frac{3}{4}$ per cent. above those at June, 1934. As compared with a year ago there has also been some increase in the cost of clothing, with the result that the index-number for all articles of working-class consumption taken together was 138 at 1 June compared with 137 at 1 May, 142 at 1 Jan., 1934, and 136 at 1 June, 1933. Compared with July, 1914, the prices of milk have advanced 65 per cent. and fish 100 per cent., while there have been substantial rises in tea, bread and most classes of meat. On the other hand, butter, cheese and eggs are from 13 to 25 per cent. below pre-war prices. The index number at 1 July 1934 was 122 for food and 141 for all articles.

The returns of retail sales for April prepared by the Bank of England and the Association of Retail Distributors show for the first time for six months a decline in the average daily sales as compared with the corresponding month in 1933, and the index-number for the former month stood at 101 * compared with 104 for April, 1933. The result is no doubt due principally to the fact of Easter falling earlier this year and the holiday purchases swelling the totals for March instead of April. The decline in the average daily sales was common to all districts and varied from 2 to 5 points

* Average daily sales in 1933 = 100.

in the index-number, or an average of 2.9 per cent. Following on the decline in April there was an increase in the average daily sales in May compared with May, 1933, of 7.7 per cent. and this was no doubt due in great part to a similar reason, viz. the occurrence of the Whitsuntide holiday in that month instead of in June as in 1933. The increase of 7.7 per cent., however, is the largest proportionate increase since the statistics were first collected, and part of it was probably due to a real improvement in trade.

The following table gives for the principal foreign countries and British Dominions the percentage increases on 1 July, 1933,* and on the latest available date in the retail prices of food and other articles (rent, clothing, fuel, etc.) compared with the prices at July, 1914.

	Retail Prices of Food at		Retail Prices of All Items at		Date of Latest Return.
	July, 1933.*	Latest date available.	July, 1933.†	Latest date available.	
	Per cent.	Per cent.	Per cent.	Per cent.	
Great Britain	18	17	38	38	1 June, 1934
<i>British Dominions.</i>					
Australia	18	22	18	18	1st Qr., 1934
Canada	— 5	6	20	25	April 1934
Irish Free State	29 ||	33	49 ||	49	April, 1934
New Zealand	4	11	27	29	April, 1934
South Africa	— 2	5	14	17	April, 1934
<i>Foreign Countries.</i>					
Austria (Vienna)	4	0	5	4	May, 1934
Belgium	—	—	595	562	May, 1934
Czechoslovakia (Prague)	562	520	596	579	April, 1934
Denmark	—	—	60	65	April, 1934
Egypt (Cairo)	1	7	24	24	Feb., 1934
Finland	777	726	883	857	April, 1934
France (Paris)	408	399	416 ¶	426	1st Qr., 1934
Germany	11	14	19	21	April, 1934
Holland (Amsterdam) ...	17	26	37 **	42	March, 1934
Italy	293	269	250 †	250 †	—
Norway	32	30	48	47	April, 1934
Spain (Madrid)	80	85	—	—	Oct., 1933
Sweden	23	22 ‡	53	53	April, 1934
Switzerland	16	15	31	30	April, 1934
United States	5	8	28	35 §	May, 1934

* Or nearest date available.

† July to Dec., 1933.

‡ March, 1933.

§ Dec., 1933.

|| Aug., 1933.

¶ 3rd quarter, 1933.

** June, 1933.

The steady and continuous increase in employment which has taken place since January, 1934, was slightly arrested at the end

of June, when the numbers recorded as unemployed on the registers of the Employment Exchanges of the Ministry of Labour in Great Britain rose from 2,090,381 at the 14th May to 2,092,586, an increase of 2,205. The increase was entirely due to a rise of 106,000 in the number of workpeople temporarily stopped, the numbers wholly unemployed or in their normal casual employment having fallen 104,000. Nearly 65,000 of the increase of 106,000 in the numbers temporarily stopped were in the coal-mining industry, and this was due partly to summer seasonal slackness and partly to suspensions on account of the exhaustion of quotas for the second quarter of the year. There was again a considerable falling off in the woollen and worsted industry which has persisted for some months. Apart from this latter industry all the principal trades are better employed than a year ago. In metal, engineering, and shipbuilding and in the building trades employment shows a very considerable improvement, though it is still slack in shipbuilding, cotton, woollen and worsted, and public works contracting. The set-back in the tailoring and in the boot and shoe industries in June is to some extent seasonal.

The proportion unemployed in Great Britain and Northern Ireland in the insured trades at the end of June was 16.5 per cent. compared with 16.3 per cent. at the end of May, and 16.7 per cent. at the end of April. At the end of June, 1933, the proportion unemployed was 19.4 per cent. Unemployment continues lowest in the London (8.4 per cent.) and South-Eastern (7.0) districts and highest in Wales (33.2). In the North-Eastern and North-Western Districts and in Scotland it is still very severe (20 to 23.4 per cent.).

The numbers on the registers of the employment exchanges in Great Britain at the end of the last four months are given below.

Date.	Wholly Unemploy ed.	Temporarily Stopped.	Persons normally in (actual Employment.	Total.
March 19, 1934	1,796,787	312,622	92,168	2,201,577
April 23, 1934	1,729,242	329,913	89,040	2,148,195
May 14, 1934	1,658,677	341,028	90,676	2,090,381
June 25, 1934	1,563,432	447,320	81,834	2,092,586
June 26, 1933	1,854,322	463,712	90,071	2,438,108

It is not easy to estimate exactly the fall in unemployment in Germany during the last three months, April to June, 1934. According to official reports the number stated by the employment exchanges as unemployed at the end of June, 1934, was 2,482,222 or 316,000 less than at the end of March. Of these 796,920 were in

receipt of poor relief compared with 985,300 three months previously. These numbers represent a decline in unemployment of roughly 50 per cent. compared with June, 1933, when the number unemployed as reported by the employment exchanges was 4,857,000 and the number in receipt of poor relief over 2,000,000. The numbers now reported do not apparently include able-bodied unemployed or relief works and persons engaged in voluntary labour service. In addition, official returns report 14.9 per cent. of 6,909,000 members of the German Labour Front as unemployed at the end of May compared with 25.4 per cent. at the end of January, 1934. The exact amount of the improvement in employment is, therefore, in some doubt as compared with 1933. During the last six months, however, it is clear that there has been quite a considerable fall in the amount of unemployment.

Employment in France showed very little change during the three months March to June, 1934, and according to the official special monthly investigations, employment in industrial and commercial, mining and transport undertakings remained at about 2½ per cent. below the level of a year ago. About 22 per cent. of those employed were working less than 40 hours per week at the beginning of June. The number on the registers of employment exchanges at the end of June was 345,314, a decline of about 7,000 since the end of the previous month and of 34,000 since the end of March, 1934.

Employment in Italy has continued to improve and at the end of May was better than in May, 1933, and considerably better than in January, 1934. The number of members of the National Social Insurance Fund who were out of work at the end of May was 941,257, a decrease of about 117,000 compared with the end of January, 1934, and of about 59,000 compared with May, 1933.

In both Denmark and Sweden employment has continued to improve and is appreciably better than in 1933, the latest recorded rate of unemployment among trade unionists being 15.0 per cent. (May) and 15.8 per cent. (June), respectively as compared with 21.9 per cent. in each country in the corresponding periods a year ago. In Norway there has been little change and employment remains depressed.

In Belgium there has been little improvement since the beginning of the year and very little change compared with 1933. About 19.4 per cent. of the members of Approved Unemployment Insurance Societies were recorded as unemployed at the end of April, 1934, compared with 19.9 per cent. at the end of December, 1933. Very little change is shown as compared with the spring of last year.

In Austria, Poland and Czechoslovakia employment has improved

since the beginning of the year. In Poland the improvement was largely seasonal and the number registered at employment exchanges is still considerably in excess of what it was at the corresponding periods in 1933. In Austria and Czechoslovakia, however, employment is considerably better than a year ago. In Holland employment continues depressed but has improved during the first four months of the year. The proportion unemployed among members of the subsidized unemployment funds has fallen from 31.5 per cent. during the last week in January, 1934, to 21.6 per cent. for the corresponding period in April. In April, 1933, the proportion out of work was 24.3 per cent. The number of unemployed applicants registered at employment exchanges at the end of April, 309,900 showed little change as compared with a year ago.

The fairly continuous improvement in employment in the United States since the spring of 1933 was maintained up to April, 1934, but there was a noticeable slackening in May, and according to the returns received in the Federal Bureau of Labour from representative establishments in the principal manufacturing industries, the numbers employed at the middle of May showed only an increase of 0.1 per cent. compared with the previous month. The aggregate weekly earnings for the same period showed a decline of 0.3 per cent. The monthly index-number of employment (average of 1923-5 = 100) was 82.4 in May, 82.3 in April and 80.8 in March, 1934. In May, 1933, the index-number was as low as 62.6. The American Federation of Labour reports that in twenty-four cities 24 per cent. of the members of affiliated unions were unemployed in May, 1934, compared with 33 per cent. in May, 1933.

Employment in Canada continues to improve and is much better than at any time in 1932 or 1933. The index-number of employment (average of 1926 = 100) was 96.6 at the beginning of June, 1934, compared with 92.0 in May, 80.7 at the beginning of June, 1933, and 89.1 at the corresponding date in 1932.

The prices of agricultural produce in England and Wales continued to show a rising tendency during the first half of the current year, the monthly index-numbers compiled by the Ministry of Agriculture being in each case higher than the corresponding months of 1933. If allowance is made for the "deficiency payment" under the Wheat Act, 1932, the index-numbers are further increased by about 5 points and stand at or above the same level as 1932 though still below the level of 1931.

The following table gives the index-numbers published by the Ministry for the six months Jan.-June in each year from 1931,

together with "revised" index-numbers due to the Wheat Act payments of 1934.

	Jan.	Feb.	Mar.	Apl.	May	June
1934.....	114	112	108	111	112	110
1934 (revised)	119	117	113	117	117	114
1933.....	107	106	102	105	102	100
1932.....	122	117	113	117	115	111
1931.....	130	126	123	123	122	123

It will be seen that the ordinary index figures for May and June, 1934, were 10 points higher than last year, while if the "revised" index is taken, which is presumably the better comparison, the increase is 15 and 14 points respectively. The effect of the wheat bonus is shown by the fact that the index-number for wheat alone if based on current market prices (as in the ordinary index) for June, 1934, was 67, whereas if the "deficiency payment" is taken into consideration the wheat index is raised to 126.

The flood of official and semi-official documents which reaches this office is so great that it is impossible to give contemporaneous or adequate notice of even a fraction of them. To this outpouring the League of Nations largely contributes. Among its publications (issued by Allen and Unwin) may be noted the following:—*Taxation of Foreign and National Enterprises* (Vol. II, 467 pp., 12s. 6d.; Vol. III, 254 pp., 7s. 6d.; Vol. IV, 219 pp., 6s.; Vol. V, 78 pp., 2s. 6d.—all dated 1933). The first two volumes give particulars for 17 countries, the Free City of Danzig, and the States of Massachusetts, New York, and Wisconsin; the first volume covered five countries (France, Germany, Spain, the United Kingdom, and the United States). The principal object of the enquiry was "a study of the methods actually employed for the allocation or apportionment of the income of enterprises having establishments in countries other than that of their fiscal domicile. Its purpose was to provide the Fiscal Committee with the data necessary for formulating a draft convention for the avoidance of the double taxation of business income." In the fourth volume Mitchell B. Carroll, formerly Special Attorney to the United States Treasury, digests "the present legislation, jurisprudence, and practice of the States covered by the enquiry" and sets forth some practical conclusions. The fifth volume is an excursus by Ralph C. Jones, Associate Professor of Accounting, Yale University, on "Allocation Accounting for the Taxable Income of Industrial Enterprises." From the League also comes a report on *Commercial Banks, 1925-1933* (1934, pp. 336), in continuation of the first report for

1913-1929, published in 1931. The introduction discusses the relationship of the banking systems to the world depression, with particular reference to the use of credit and to its contraction during the slump. The major part of the volume is occupied with summaries of the banking position in forty countries. "An attempt has been made to achieve a maximum of international comparability among the various groups and sub-groups of the standard balance-sheet used; but the limitations of the basic statistics render complete comparability impossible." *International Trade Statistics, 1931 and 1932* (1933, pp. 365, 10s.), in French and English, is a supplement to volume II of the 1912-26 issue of the *Memorandum on International Trade and Balances of Payments*, and contains statistics of the trade of 65 countries for 1930-32. The information is, necessarily, very compressed, but of particular value is a long table showing the percentage distribution by countries of each country's imports and exports. Another important volume, prepared by Mr. J. B. Condliffe, of the Economic Intelligence Service of the League, is the second annual issue of *World Economic Survey*, covering the period 1932-33 (1933, pp. 345, 6s.). It is "intended to afford an account of recent developments intelligible to the lay reader." The chapter headings give a fair idea of the contents:—a troubled year, the confusion of prices, the disorganisation of production, wages and social policy, the profits of enterprise, the strain on the public finances, international trade and commercial policy, monetary and credit policies, a world in debt, the balancing of international accounts, the economic situation in July, 1933.

Internationaler Steuerbelastungsvergleich (1933, Berlin, Hobbing, pp. xxi + 779) is a large folio volume prepared in the Statistisches Reichsamt under the supervision of our Honorary Fellow, Dr. Wagemann. It deals with the taxation and social burdens on industrial and commercial undertakings in Germany, France, Great Britain, Italy, Austria, and the United States, investigates "not only the taxation of undertakings as such but that on the workers employed therein and on the foreign capital engaged in them," and covers not only tax-laws but also official orders and decrees. Another work which may be recommended to those concerned with the international comparison of government finance is *La Finanza Italiana nel centennio 1913-1932* by F. A. Répaci (Turin, 1934, pp. 316), and as a general footnote to more technical books may be mentioned two publications of the Unclaimed Wealth Utilization Committee of Geneva. These are *The Search for Confidence in 1932* (1933, King, pp. ix + 109, 6s.) and *Economic Readjustment in 1933* (1934, King,

pp. xiii + 102, 6s.) both by A. H. Abbati. As Sir Basil Blackett says in an introduction to the earlier volume they are "lively and unorthodox." Each consists of reprints of a series of bulletins "issued to indicate the major features of the economic situation as they come into prominence, to forecast their effects, to expose economic fallacies, and to formulate an independent national and international viewpoint." They are provocative of thought if not always of agreement. An old familiar friend steps in in the person—for really the book has now acquired a personality—of *The Statesman's Year-Book* for 1934 (Macmillan, xxxiv + 1478 pp., 20s.). There are two new maps of the Syro-Iraqi frontier and French Morocco. It is superfluous to praise Dr. Epstein for his industry, thoroughness, and up-to-dateness; these qualities are expected and always found in this invaluable work.

In his address at the Centenary Meeting Sir Josiah Stamp criticized the methods followed by Hungarian statisticians in calculating national income. It is pleasant to be able to record that he has been elected an Honorary Member of the Hungarian Statistical Society—a most friendly retort!

STATISTICAL AND ECONOMIC ARTICLES IN RECENT PERIODICALS.

UNITED KINGDOM—

Agricultural Economics Society, Journal of Proceedings, May, 1934—The relation of the agricultural economist to practical farm management: *J. R. Currie*. Organised marketing in relation to progress in production: *J. Ll. Davies*.

Bankers' Magazine, May, 1934—The evolution of money: *A. H. Gibson*. Banks and hire-purchase agreements: *L. Le M. Minty*.

Biometrika, May, 1934—On the P_{2n} test for randomness: remarks, further illustration, and table for P_{2n} : *Florence N. David*. On the corrections for the moment coefficients of frequency distributions when the start of the frequency is one of the characteristics to be determined: *E. S. Martin*. Die Statistik der seltenen Ereignisse: *Rolf Lüders*. On certain non-normal symmetrical frequency distributions: *G. H. Hansmann*. On certain measures of dependence between statistical variables: *J. F. Steffensen*.

Economic Journal, June, 1934—The future of gold in relation to demand: *Professor Edwin Cannan*. The demand for money: *Professor T. N. Carver*. On the relationship between investment and output: *Professor F. A. von Hayek*. The elasticity of substitution: *Professor A. C. Pigou*. The problem of management and the size of firms: *Austin Robinson*. The Reserve Bank of India: *Professor G. Findlay Shirras*.

Economica, May, 1934—Twelve months of American dollar policy: *T. E. Gregory*. "The theory of unemployment" by Professor A. C. Pigou: *R. G. Hawtrey*. The economic aspects of copyright in books: *A. Plant*. A reconsideration of the theory of value, Part II: *R. G. D. Allen*. The movement of labour into south-east England, 1920-1932: *Brinley Thomas*. A note on banking policy and the income-velocity of circulation of money: *J. C. Gilbert*.

Eugenics Review, April, 1934—The genetics of intellect: *U. C. Hurst*.

Institute of Actuaries, Journal, Part 1, 1934—An approximate law of survivorship and other notes on the use of frequency curves in actuarial statistics: *W. Palin Elderton*. The measurement of the rate of population growth: *C. D. Rich*.

Institute of Bankers, Journal, May, 1934—President Roosevelt's adventure: *W. J. Hinton*.

Lloyds' Bank Monthly Review—

May, 1934—Austrian economic development: *H. T. N. Gait-skill*.

June, 1934—Problems of stabilisation: *N. F. Hall*. Some aspects of the unemployment problem.

UNITED KINGDOM—Contd.

- Manchester School*, No. 1, 1934—The American experiment : *T. E. Gregory*. The relevance of political economy : *G. W. Daniels*. American raw cotton policy : *H. Campion*. An aspect of the problem of unemployment : *Jack Stafford*.
- Ministry of Agriculture, Journal*, June, 1934—The German fat monopoly. Some impressions of British farming : *V. Western*. Counties and Wales. The fibre content of British-milled wheat-feed : *E. A. Fisher* and *Thomas Shaw*.
- Population*, February, 1934—Population changes in England and Wales : families and dwellings : 1921–1931 : (editorial). The history of longevity in the United States : *Louis L. Dublin* and *Alfred J. Lotka*. Racial and social problems in the light of heredity : *Professor R. Ruggles Gates*. On the concept of an optimum in population theory : *Lindley M. Fraser*. A note on the population of Egypt : *M. El-Darwish* and *H. El-S. Azmi*. Migration in the twentieth century : *Professor John Coatman*.
- Public Administration*, April, 1934—The changing population : *J. Johnstone Jervis*.
- July, 1934—The system, methods and management of registries in large government departments : *A. C. Pigou*. The administrative problem of unemployment relief in Germany : *L. Richter*.
- Royal Meteorological Society, Quarterly Journal*, April, 1934—Sir Napier Shaw's eightieth birthday. The march of meteorology : random recollections : *Sir Napier Shaw*.
- Royal Society of Arts, Journal*, June, 1934—The co-operative movement in Africa : *C. F. Strickland*.
- Royal Society of Edinburgh, Proceedings*. Session 1933–34—On fitting polynomials to weighted data by least squares : *A. C. Aitken*. On fitting polynomials to data with weighted and correlated errors : *A. C. Aitken*.
- Westminster Bank Review*, May, 1934—Rising or falling prices ?

INDIA—

- Indian Journal of Economics (Conference Number)*, January, 1934—The broken balance of population, land and water : *Radha Kamal Mukherjee*. Population problems : *H. B. Bhide*. The problem of Indian over-population : *Jafar Hasan*. On the maximum of population : *S. Subramanian*. Some conclusions concerning the inter-relationship of birth-rates, death-rates, prices and rainfall in the United Provinces : *Murli Dhar Joshi*.

UNITED STATES—

- American Academy of Political and Social Science, Annals*, May, 1934—The ultimate consumer: a study in economic illiteracy (Whole number).

UNITED STATES—Contd.

Annals of Mathematical Statistics, March, 1934—The accuracy of computation with approximate numbers: *Helen M. Walker* and *Vera Sanford*. Combining two probability functions: *William Dowell Baten*. On the systematic fitting of straight line trends by stencil and calculating machine: *Herbert A. Toops*. Statistical analysis of one-dimensional distributions: *Robert Schmidt*.

Econometrica, April, 1934—Francis Ysidro Edgeworth: *Arthur L. Bowley*. Significant developments in business cycle theory: *Felice Vinci*. Capital and industrial fluctuations: *F. A. von Hayek*. A comparison between different definitions of complementary and competitive goods: *R. G. D. Allen*. Interdependence of cyclical and seasonal variation: *J. Wiśniewski*.

Harvard Business Review, April, 1934—The equation of economic balance: *M. C. Rorty*. A quantitative study of economic balance: *Ragnar D. Naess*. Costs and the government control of business: *Thomas H. Sanders*.

Journal of Political Economy, April, 1934—The failure of monetary policy to prevent the depression of 1929–32: *Lauchlin Currie*. Inflation and enterprise in France, 1919–26: *Max J. Wasserman*. Workmen's compensation experience in Ohio during the depression: *Louis Levine*.

Quarterly Journal of Economics, May, 1934—The periodogram of American business activity: *Edwin B. Wilson*. A British experiment in the control of competition: the Coal Mines Act of 1930: *Arthur F. Lucas*. Doctrines of imperfect competition: *R. F. Harrod*. British and American Exchange policies: the British experience: *S. E. Harris*.

Review of Economic Statistics—

April, 1934—British and French economic conditions: (communicated). Inflationary aspects of recent banking developments: (communicated).

May, 1934—British and French economic conditions: (communicated). Review of the first quarter of 1934: *J. B. Hubbard* and *W. L. Crum*. Inflation: *C. J. Bullock*.

Wheat Studies of the Food Research Institute, Stanford University, May, 1934—World wheat survey and outlook, May, 1934.

ARGENTINA—

Revista de Ciencias Económicas—

January, 1934—Interés o dividendo? Un interrogante al mundo: *Hjalmar Schacht*. La vialidad en la República Argentina. Su evolución y estado actual: *Teodoro Sanchez de Bustamante*.

March, 1934—Equilibrios económicos: *A. Eduardo Sanguinetti*.

BELGIUM—

Bulletin de l'Institut des Sciences Economiques, May, 1934—La sidérurgie belge : l'équilibre aux différents stades de la production et du commerce extérieur des produits métallurgiques de 1897 à 1933 : *Jean Jussiant*.

Revue du Travail, April, 1934—Principaux résultats d'une enquête sur les budgets d'ouvriers et d'employés en Belgique (1928-1929) : *A. Julin*.

May, 1934—L'influence des lois sociales sur l'économie du pays : *Léon Delsinne*.

DENMARK—

Nationaløkonomisk Tidsskrift, Hefte 2, 1934—Forskydninger i Nutidens sociale Lagdeling : *Theodor Geiger*. Udenrigssomsætningens Betydning for Danmarks Økonomi : *Th. Juncker*. Træk af Sovjetunionens Planøkonomi, dens Udvikling og Resultater : *Aage Fjellerup*.

FINLAND—

Social Tidskrift, No 5, 1934—Les accidents d'automobile et leurs causes en 1933. I-V. (In Finnish and Swedish.)

FRANCE—

Revue d'Économie Politique, March-April, 1934—La théorie de l'intérêt, d'après Irving Fisher : *Adolphe Landry*. Quelques nouvelles observations statistiques sur le chômage : *Henri Guitton*. L'activité des institutions économiques internationales : *René Courtin* and *Pierre Dieterlen*.

Journal des Économistes—

April, 1934—Corporatisme et politique : *F. Gaucherand*. Le commerce extérieur des principaux pays en 1933 : *R. J. Pierre*. L'industrie houillère française en 1933 : *E. P.*

May, 1934—Vers la réforme fiscale : *Edouard Payen*. L'industrie automobile : *R. J. Pierre*.

Journal de la Société de Statistique de Paris—

May, 1934—La population de Paris d'après le recensement de 1931 : *M. Penglaou*.

June, 1934—Le problème des dettes de guerre d'après des statistiques américaines et des comptes de guerre français postérieurs à la ratification des accords Mellon : *V. de Marce*. Bibliographie : monographies sur l'organisation de la statistique administrative dans les différents pays : *R. Rivet*.

GERMANY—

Allgemeines Statistisches Archiv, Heft 4, 1934—Gesundheitsstatistik : *Albert Zwick*. Die Krebssterblichkeit im Bodenseegebiet : *M. Hecht*. Schicksalsstatistik der Krebskranken : *Maximilian Meyer*. Wohlfahrtspflege und Arbeitslosenfürsorge 1914 bis 1932 : *Dr. Kleindinst*. Eine statistische Sonderaufgabe auf dem Gebiet der Arbeitslosigkeit und ihre Lösung : *Dr. von Valta*. Zum gegenwärtigen Stande der deutschen Finanzstatistik : *Hans Reiner*.

GERMANY—*Contd.*

Deutsches Statistisches Zentralblatt—

December, 1933—Eugen Würzburger als Hauptherausgeber des Deutschen Statistischen Zentralblatts: *Dr. Meerwarth.*

Hefte 1-2, 1934—Statistisches Wissen ist Macht.

Vierteljahrshefte zur Konjunkturforschung, Heft 1, 1934, Teil A—Die Konjunktur im Frühjahr 1934.

Weltwirtschaftliches Archiv, May, 1934—Die Entwicklung des Aussenhandels der Niederlande nach dem Kriege: *Willem L. Valk.* Die Erfüllung des russischen Fünfjahrplanes: *Wassily Leontief.* Strukturwandlungen am Weltmarkt für Papier, Pappe, Holzschliff und Zellstoff: *W. Twerdochleboff.* Über die Agrarpolitik der Vereinigten Staaten von Amerika: *Karl Schiller.* Internationale Kongresse und Konferenzen im Jahre 1933: *Fritz Lotsch.*

HUNGARY—

Journal de la Société Hongroise de Statistique, Nos. 1-2, 1934—Contributions aux questions de source et de méthode de la statistique historique hongroise: *G. Thirring.* Sur l'emploi des moyennes géométriques et arithmétiques: *Ch. Jordan.* The situation of agriculture in Hungary in the light of statistics: *J. de Konkoly Thege.* Problèmes des indices: *E. Varga.*

ITALY—

Annali di Statistica e di Economia, Vol. II, 1934—La produzione agricola italiana e la crisi mondiale: *Federico Chessa and Carlo Martini.* Il piano Mlynarski—credito e pace: *F. Chessa.*

Economia—

March, 1934—Analisi del risparmio: *Vincenzo Consiglio.* Lo sviluppo delle relazioni commerciali con l'Austria: *Aristide Landi.*

April-May, 1934—Per una politica corporativa delle esportazioni: *Enzo Casalini.*

Giornale degli Economisti, March, 1934—Parallelo finanziario fra assicurazione privata e assicurazione sociale: *Filadelfo Insolera.* Tavola di fecondità dei matrimoni per l'Italia (1930): *Giorgio Mortara.* Nuovi dati sulla natalità in Italia: *Giorgio Mortara.*

La Riforma Sociale, March-April, 1934—La corporazione aperta: *Luigi Einaudi.* Il problema delle esportazioni: *Edoardo Giretti.* Il problema odierno della marina mercantile: *Michele Schiavone.*

Rivista Italiana di Statistica, Economia e Finanza, April, 1934—La previsione dei fatti economici: *G. Masci.* Economia e demografia: *F. Vinci.* Il rapporto dei sessi nelle fratellanze dei genitori delle famiglie numerose: *M. Tirelli.* Il significato teorico e pratico degli indici dei prezzi: *D. Tenderini.*

INTERNATIONAL—

International Labour Review—

April, 1934—The new German Act for the Organisation of National Labour. Some problems in the construction of index numbers of unemployment: *John Lindberg*.

May, 1934—Rationalisation and the employment and wages of women in Germany: *Judith Grünfeld*. The international regulation of hours of work on railways. Workers' education in Great Britain: *Professor John H. Nicholson*.

Metron, Vol. XI. No. 4—Die Konzentration einer Verteilung und ihre Abhängigkeit von den Grenzen des Variationsbereiches: *Hermann von Schelling*. Sullo scarto quadratico medio della probabilità di transvariazione: *V. Castellano*. Sur les développements des fonctions des fréquences en séries de fonctions orthogonales: *Carlos E. Dieulefait*.

LIST OF ADDITIONS TO THE LIBRARY.

Since the issue of Part II, 1934, the Society has received the publications enumerated below :—

I.—OFFICIAL PUBLICATIONS.

(a) United Kingdom and its several Divisions.

United Kingdom—

Agriculture, Ministry of—

Economic series no. 39. Reorganisation Commission for Fat Stock for England and Wales, Report. London: H.M.S.O., 1934. 9" × 6"; 129 pp. 1s.

Agricultural output of England and Wales, 1930–1931. Report on certain statistical enquiries relating to the output of agricultural produce and to the agricultural industry in general, together with the results of earlier enquiries of a similar nature. London: H.M.S.O., 1934. 9½" × 6"; 67 pp. 1s.

Economic Advisory Council. Committee on Cattle Diseases, Report. London: H.M.S.O., 1934. 9½" × 6"; 161 pp. 2s. 6d.

Education, Board of. Educational pamphlets no. 99. Education and the countryside. London: H.M.S.O., 1934. 7½" × 4½"; 106 pp. 1s. 6d.

Exchequer and Audit Department. Wheat fund accounts 1932–1933. London: H.M.S.O., 1934. 9½" × 6"; 8 pp. 2d.

Health, Ministry of. Reports on public health and medical subjects, no. 71. The bacteriological examination of water supplies. London: H.M.S.O., 1934. 9½" × 6"; 38 pp. 9d.

Overseas Trade, Department of. Reports: 573. Denmark, Feb. 1934. 78 pp. 2s. 6d. 574. Southern Rhodesia, Northern Rhodesia and Nyasaland, 1933. 85 pp. 2s. 6d. 576. Poland. 63 pp. 2s.

[London: H.M.S.O., 1934. 9½" × 6"; 3 parts.]

Trade, Board of—

Departmental Committee on the Law and Practice relating to Trade Marks, Report. London: H.M.S.O., 1934. 9½" × 6"; 93 pp. 1s. 6d.

Survey of industrial development, 1933. Particulars of factories opened, extended and closed in 1933 with some figures for 1932. London: H.M.S.O., 1934. 9½" × 6"; 36 pp. 6d.

Transport, Ministry of. Report on fatal road accidents which occurred during the year 1933. London: H.M.S.O., 1934. 13" × 8½"; 53 pp. 1s.

Scotland—

Agriculture, Department of. Scottish Fat Stock Marketing Reorganization Commission, Report. Edinburgh: H.M.S.O., 1934. 9½" × 6"; 66 pp. 1s.

Health for Scotland, Department of. Milk consumption in Scotland: an enquiry into the average amount of milk consumed in Scottish households. By G. Leighton and P. L. McKinlay. Edinburgh: H.M.S.O., 1934. 9½" × 6"; 36 pp. 9d.

Registrar-General's Office. Census of Scotland, 1931. Report on the fourteenth decennial census of Scotland. Vol. III. Occupations and industries. Edinburgh: H.M.S.O., 1934. 13" × 8"; xlv + 492 pp. 25s.

Scottish Office. Committee on Scottish Barley for use by Scottish Distilleries (1934), Report. Edinburgh: H.M.S.O., 1934. 9½" × 6"; 20 pp. 4d.

(b) Dominions, Colonies, and Protectorates.

Canada—

Dominion Bureau of Statistics—

- Original monthly statistics of chief economic importance covering the post-war period from 1919-1933, together with illustrative charts. Ottawa, 1934. 11" \times 8 $\frac{3}{4}$ "; 85 pp.
- Seventh census of Canada, 1931. Census of agriculture. Final bulletins: XXIV. Forest products of farms by counties or census divisions 1930. 43 pp.
- XXV. Conditions of farm land by counties or census divisions 1931. 28 pp.
- XXVI. Area of field crops by counties or census divisions 1931. 50 pp. [Ottawa, 1934. 11" \times 8 $\frac{1}{2}$ ".]

(c) Foreign Countries.

China—

Shanghai. Bureau of Social Affairs. Strikes and lock-outs in Shanghai since 1918. Shanghai, 1933. 10 $\frac{1}{4}$ " \times 7 $\frac{1}{2}$ "; xi + 115 + 179 pp. \$5.

Germany—

Statistisches Reichsamt. Statistik des Deutschen Reichs. Band 440. Die Ausgaben und Einnahmen der öffentlichen Verwaltung im Deutschen Reich für das Rechnungsjahr 1931-32. Berlin, 1934. 12" \times 8 $\frac{3}{4}$ "; 159 pp. 9 Rm.

Poland—

Office Central de Statistique. Statistique de la Pologne—

- Série A. Vol. 27. Mariages, naissances et décès 1927, 1928. Warsaw, 1934. 13" \times 9 $\frac{1}{2}$ "; xvii + 132 pp.
- Série C. Fasc. 2. Les causes des divergences entre les statistiques du commerce extérieur, polonaises et étrangères, par Dr. S. Guterman. x + 29 pp. Fasc. 3. La statistique de la vie intellectuelle et culturelle. 22 pp.

[Warsaw, 1934. 11 $\frac{1}{2}$ " \times 8 $\frac{1}{2}$ ".]

Saar Basin—

Statistisches Amt. Bericht des Statistischen Amtes des Saargebietes. Heft 11, 1933. Saarbrücken, 1933. 10" \times 7 $\frac{1}{4}$ "; 397 pp.

Switzerland—

Eidgenössisches Statistisches Amt—

- Eidgenössische Viehzählung mit Geflügel-, Bienenvölker- und Kaninchenzählung, 1931. Bern, 1934. 11 $\frac{1}{4}$ " \times 8". 284 pp.
- Eidgenössische Volkszählung 1 Dezember 1930. Bände: 11. Kanton Luzern. 99 pp. 12. Canton du Valais. 127 pp. 13. Cantone Ticino. 129 pp. 14. Kanton Solothurn. [Bern, 1934. 11 $\frac{1}{4}$ " \times 8"; 4 parts.]

United States—

Agriculture, Department of—

Circulars—

288. Market classes and grades of pork carcasses and fresh pork cuts. 35 pp. 10 c.
296. Diets at four levels of nutritive content and cost. 58 pp. 5 c.
- [Washington, 1933. 9" \times 6"; 2 parts.]

United States—Contd.

Agriculture, Department of—

Farmers' Bulletins—

1117. Forestry and farm income. 31 pp.

1199. Judging sheep. 17 pp. 5 c.

1437. Swine production. 36 pp. 5 c.

1443. Dairy cattle breeds. 32 pp. 5 c.

1718. Important sugar-beet by-products and their utilization. 29 pp. 5 c. [Washington, 1934. 9" × 6"; 5 parts.]

Miscellaneous publication, 183. Food budgets for nutrition and production programs. Washington, 1933. 9" × 6"; 15 pp. 5 c.

Statistical bulletins—

43. Corn futures, volume of trading, open commitments and prices from Jan. 2, 1930, to Dec. 31, 1932. 99 pp. 10 c.

44. Stumpage and log prices 1931 and 1932. 104 pp. 5 c. [Washington, 1933. 9" × 6"; 2 parts.]

II.—AUTHORS AND MISCELLANEOUS.

- Actuaries, Institute of, and Faculty of Actuaries. Continuous investigation into the mortality of assured lives. Monetary tables. A. 1924–29. Vol. I. Cambridge: University Press, 1934. 9½" × 6"; xxxix + 339 pp. 63s.
- Adkin (B. W.) and Lawrence (Davis M.). The Compulsory Purchase Acts; a treatise on the law and practice of compensation, for surveyors, valuers, auctioneers and estate agents. 2nd ed. London: Estates Gazette, 1930. 8¼" × 5¼"; xxiii + 464 pp. (From Mr. Richard Harper.)
- Ashworth (Robert). The structure of business management. London: Gee and Co., 1934. 8½" × 5½"; 48 pp. 3s.
- Banco do Brasil. Relatório do Banco do Brasil apresentado à assembléa geral dos acionistas na sessão ordinária de 28 de abril de 1934. Rio de Janeiro, 1934. 9½" × 7"; 45 pp.
- Braesch (F.). Finances et monnaie révolutionnaires. (Recherches, études, et documents.) Fasc. 1. Les exercices budgétaires 1790 et 1791 d'après les comptes du trésor. Nancy, 1934. 10" × 6½"; vii + 129 pp.
- Burr (G. B.) and Staples (Ronald). "Taxation" practitioners' guide. London: Gee and Co., 1934. 11" × 9"; 55 pp. 7s. 6d.
- Crelle (A. L.). Dr. A. L. Crelle's calculating tables giving the products of every two numbers from one to one thousand and their application to the multiplication and division of all numbers above one thousand. Revised by Dr. C. Bremiker. First English edition. London: D. Nutt, 1897. 13" × 9¼"; vii + [498] pp.
- Dubey (Daya Shankar) and Agrawal (Shankar Lal). Elementary statistics for Indian students. Vol. 1. Allahabad: Indian Press, 1934. 8½" × 5"; xii + 336 + 19 + iv pp. Rs. 6.
- Fisher (R. A.). On the mathematical foundations of theoretical statistics. (*Philosophical Transactions of the Royal Society*, Series A. Vol. 222.) London: Harrison, 1922. 11¼" × 9"; [60 pp.] 7s.
- Theory of statistical estimation. Cambridge: Reprint from *Proceedings of the Cambridge Philosophical Society*. Vol. XXII, Part 5, 1925. 8½" × 5½"; [27] pp. (From the author.)
- Fluz (A. W.). Industrial productivity in Great Britain and the United States. Cambridge, Mass.: Reprint from *Quarterly Journal of Economics*, Nov. 1933. 9½" × 6½"; 38 pp. (From the author.)
- Ford (P.). Work and wealth in a modern port: an economic survey of Southampton. London: Allen and Unwin, 1934. 8½" × 5½"; 223 pp. 10s. 6d.
- Fowler (R. F.). The depreciation of capital analytically considered. London: P. S. King, 1934. 7¼" × 4½"; xii + 143 pp. 6s.
- Geary (Frank). Land tenure and unemployment. London: Allen and Unwin, 1925. 8½" × 5½"; 256 pp. (From Mr. Richard Harper.)

II.—Authors and Miscellaneous—Contd.

- George (Henry), Jr.* The life of Henry George. London: William Reeves, 1900. 8" × 5"; 634 pp. (From Mr. Richard Harper.)
- Gumbel (E. J.).* L'état limité. Rome: Istituto Italiano degli Attuari, 1934. 9½" × 6½"; 31 pp.
- Harris (F. W.).* Atmospheric pollution: its sources, extent and measurement. Paper . . . read before the Royal Philosophical Society of Glasgow, March, 1934. Glasgow, 1934. 11" × 8½"; 15 pp. + V appendices.
- Hevesy (Paul de).* Le problème mondial du blé. Project de solution. Paris: Felix Alcan, 1934. 10" × 6½"; vii + 293 pp. 30 fr.
- Hirst (F. W.).* The consequences of the war to Great Britain. London: Oxford University Press, 1934. 9½" × 6½"; xx + 311 pp. 10s.
- Idriess (Ion L.).* Gold-dust and ashes: the romantic story of the New Guinea Goldfields. Sydney: Angus and Robertson, 1934. 7½" × 4½"; x + 285 pp.
- Irwin (J. O.).* Statistical methods in psychology—the present position of the theory of two factors. (XXII^e Session de l'Institut International de Statistique, Londres 1934.) La Haye, 1934. 10½" × 7½"; 14 pp. (From the author.)
- Isserlis (L.).* Classification of steam and motor shipping owned in the United Kingdom. (XXII^e Session de l'Institut International de Statistique, Londres, 1934.) La Haye, 1934. 10½" × 7½"; 13 pp. (From the author.)
- Jones (D. Caradog),* Editor. With the assistance of J. E. McCrindell, H. J. H. Parker, C. T. Saunders, and N. L. Hume (Secretary). The social survey of the Merseyside. Liverpool: University Press (London: Hodder and Stoughton), 1934. 8½" × 5½"; 3 vols. 45s.
- Jones (J. Harry).* The economics of saving. London: Reed and Co., 1934. 7" × 4½"; xvi + 171 pp. 4s. 6d.
- Jordan (Charles).* Sur l'emploi des moyennes géométriques et arithmétiques. Budapest: Reprint from *Journal de la Société Hongroise de Statistique*, 1934, Nos. 1-2. 9" × 6"; 11 pp. (From the author.)
- *Teoria della perequazione e dell'approssimazione.* Rome: Istituto Italiano degli Attuari, 1934. 9½" × 6½"; 29 pp.
- Labordère (Marcel).* Tableau de la production, des importations et des exportations de l'or en 1932. Coulommiers-Paris: Paul Brodard, 1934. 9½" × 6"; 58 pp. (From the author.)
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JOURNAL
OF THE ROYAL STATISTICAL SOCIETY
PART IV, 1934.

DISCUSSION ON METHODS USED IN DIFFERENT COUNTRIES
FOR ESTIMATING NATIONAL INCOME.

[Held before the Royal Statistical Society, May 15, 1934, PROFESSOR M.
GREENWOOD, F.R.S., Vice-President, in the Chair.]

THE discussion on Sir Josiah Stamp's paper, read at the Centenary Meeting, April 17, was continued at this meeting.

PROFESSOR A. L. BOWLEY : Besides the paper read by Sir J. Stamp and the other contributions to the Centenary Meeting of the Royal Statistical Society, we have to bring into consideration the work on the subject of "National Wealth and Income" undertaken by a Committee of the International Statistical Institute. Professor Gini made a provisional report for this Committee in April, and Professor W. Mitchell and Dr. Kuznets contributed a paper on behalf of the National Bureau of Economic Research. Both these bodies are continuing the study of the subject, especially with reference to the establishment of international standards of definition.

These communications taken together contain a very exhaustive account of various definitions of income and of the methods which have been used for its estimate; it is impossible to summarize them briefly, nor would it be advisable to attempt to do so for the present discussion. It appears to be better to select particular questions, especially those which have come into prominence in recent times.

It is thirty-nine years since I first had the honour of discussing national income with the Society in connection with my first paper on Wages; then I based certain estimates on Giffen's Essay on Recent Accumulations of Capital, 1878, and on Baxter's estimates, and worked backwards and forwards from these accounts by the use of index-numbers of wages and tax-paying income. In this process total income is divided into three or more constituent parts; some of the items depend on very rough estimates, and the results were used, not for estimating total income but with reference to the changing proportions of wages to other parts of income. At the same

time some elements of income, that would be included under some definitions, were omitted altogether. Here are four topics to the consideration of which I propose to devote most of my time.

1. *The Itemization of Income.* In our account of the income of the United Kingdom in 1924 Sir J. Stamp and I gave some seventeen different items and other subdivisions, which were added up in different ways so as to give total income corresponding to five or more different conceptions of national income. The items were based on different sources of information or estimate, and in fact the method was determined by these sources. In other countries the sources of information are of different kinds, but it is often possible to distinguish income from ownership, from salaries, from wages, from pensions, etc., and to separate income accruing to residents or to foreigners, income arising abroad, and more roughly to estimate the change made by new territorial boundaries. A great deal would be gained if the content of such divisions could be defined and in each account of income such details were marked on a uniform plan. Professor Gini reported that it was not possible to apply uniform procedure in any pair of twenty countries whose statistics he had examined. With such itemization it would be possible to assemble the parts so that the wholes corresponded to the same definition in different countries, and to make the computations for various definitions. This would relieve the statistician from the necessity of choosing between definitions, a task which falls rather within the province of the economist.

Unfortunately this uniform subdivision is not always possible. In the estimates based on the Census of Production the "Net Output" includes in one undivided total rent, interest, profits, salaries, wages and other items, while in those based on income and wage statistics items are merged in a different way and small salaries are very imperfectly known. It appears to be necessary to keep these two classes of estimate quite distinct for purposes of definitions and of subdivision.

2. *Errors of Estimation.* It has been the admirable custom in presenting income statistics to this Society, at least in recent years, to give some estimate of the margin of uncertainty in the parts and total. It should be the practice of every worker to keep a running account of the possible error in every factor of every item included, and to assemble these margins in the totals. In the final process the theory of errors may be used with discretion, and in fact more attention might well be given to the accumulation or neutralization of errors in these estimates.

I have found it expedient to control the calculations by an estimate of the total number of income-receivers in the country, based on the Population Census. So long as they are all accounted for it is not always important to decide in which class they should be reckoned, and so some of the errors in detail are cancelled in the total. It is in this region that the main differences between the estimates for the year 1924 by Mr. Clark and by Sir Josiah Stamp and myself are to be located.

The importance of the almost complete ignorance about the

income of such classes as small workers on their own account, of the partly unemployed, etc., can be ascertained—as regards the effect on the total—if we know their numbers. If, for example, a class is only 2 per cent. of the whole number of income-receivers and our estimate of their average income is subject to a margin of 50 per cent., the effect on the total is only 1 per cent. But if, as in India, there is a large proportion of maker-dealers about whose income nothing is known, the effect on the total of urban incomes may be considerable.

3. *Errors in Comparisons.* It is of first importance to determine how far the rule that errors in the ratios of averages or of totals, compiled on uniform plans, are less than the errors in a single reckoning, applies to our problem. M. Simiand laid great stress on its value in his paper. If we are comparing the rate of progress in two countries, we at the same time eliminate the relative error within the definition adopted in each country and the bias between the definitions adopted—so long as these errors are constant. The same principle applies in measurements of the relative progress of different classes of income, such as earned and so-called unearned in one country. Professor Gini, however, very justly called attention in his report to the International Institute to cases where the nature of incomes had changed in the course of years and the definitions had been necessarily modified. But his main illustrations belong rather to my fourth topic, to which I now proceed.

4. *Errors of Omission.* If we decide to include in income only that part which is received in cash, we omit (a) all services paid in kind, (b) goods consumed by the producer, (c) the direct use of property, (d) unpaid services, and (e) work done by oneself for oneself.

Under every consistent definition of income one or more of these classes is included, and usually there is given some estimate of parts of (a), (b), and (c). These classes are of very different importance in the countries of the world, so different as to render futile, in my opinion, comparisons between Europe and Asia. Eight weeks ago I was watching wheat harvesting in Indore. The reapers were a travelling group, who had come a great distance on foot or by bullock cart. Their reward was one part in twenty (I think) of what they reaped. The women took this wheat, winnowed it by the roadside, where they camped, ground it in a mortar, and cooked it for the evening meal. Presumably they had some surplus to sell. How can one compare this reward with the cash wage of the driver of a motor harvester?

More generally, is there any logical method of valuing goods which are not sold or of goods provided by the employer at his choice?

As Professor Gini and others have pointed out, the relative importance of each of these classes of income has changed within several countries in recent years, and to different extents. In consequence the validity of comparisons both between dates in one country and between countries is seriously impaired. It has become necessary to estimate as best we can these changes, and to carry the resulting margin to the error in the total.

Changes in Purchasing Power. After we have done our best to

make reasoned estimates of income (with appropriate margins) within a coherent definition for two dates in one country, we have still an almost insurmountable difficulty which prevents our measuring real progress or its reverse; we have still to compare the real values of the incomes. Everyone admits the difficulty, and most writers point out the inadequacy of any existing index-numbers for such comparisons. This obstacle to giving a live interpretation to the statistics won with so much labour presents a challenge to statisticians which I hope will be seriously taken up. I have no solution to propose, but I venture the opinion that the procedure must be to obtain adequate budgets of the aggregate expenditure of individuals at the two dates and to devise index-numbers for each item of expenditure. Two results will be obtained by using the budgets at each date to provide weights, and the comparison of them may be illuminating. There remains the treatment of savings, which can perhaps be left till further progress has been made with the main problem.

Three other questions have come into prominence recently. One is the treatment of losses and gains in the market value of property. I have little doubt that they ought not to be brought into an account of income, though it may be well to deal with them in a supplement. On the other two I should be very glad to hear views of members. They are as follows:

Dr. Kuznets in his recent studies* gives two totals of income—income paid-out and income received. The second is obtained from the first by adding "business savings" or subtracting "business losses." For example, in the year 1932 income paid-out was estimated at 49,000 million dollars; in that year about 9,500 million dollars were paid to shareholders and others more than the net output of the concerns, for the income produced was only 39,500 million dollars. (These totals include income from all sources, not only from businesses.) In other words, more was distributed than was earned in the year. Where this difference is great, as it has been in the United States in some recent years, the results of adding individual incomes received and of estimating from a Census of Production will not agree. We cannot, I think, charge the difference to Capital and take the Census of Production estimate as being sufficient, without paying attention to the source of these excess payments or the method of holding undistributed profits if the balance is the other way. The question is essentially one of accountancy, but it needs very careful consideration by the income statistician.

The remaining problem depends also on accountancy methods. The American statisticians, as well as Mr. Clark here, call attention to the processes of valuing the increase or decrease of the value of stock-in-trade during a year, at cost or at current value, whichever is the less. For the year 1930 Mr. Clark † adds £251 million to the other parts of the national income under this heading. I hope that Mr. Leak will tell us how this question is treated in the Census of Production, and that we shall also hear something from the point

* See *National Income, 1929-1932*, 73rd Congress, 2nd Session. Document No. 124, p. 10.

† *The National Income, 1924-1931*, Colin Clark, p. 70.

of view of income-tax assessment. I am not clear myself that the change in value is rightly brought into the total, but in any case I would emphasize the great element of uncertainty in the estimates either of the value of stocks-in-hand or of its change. Here is another problem which I commend to experts for very careful study, the results of which will, I hope, be communicated to the Society at some future date.

MR. LEAK said that Professor Bowley had just given an interesting discussion of certain aspects of the problem of estimating national income. One of the matters to which he had referred was the influence of price changes on the national income and the difficulty of measuring such changes. Mr. Leak would endeavour later on to make a contribution on the subject of the price changes which had taken place between 1924 and 1930.

He was glad to have the honour of taking part in this discussion initiated at the Centenary Meeting by Sir Josiah Stamp in an address in every way worthy of the occasion, which would live long in the annals of the Society. He did not propose that evening to go into the general principles involved, or to discuss the merits or demerits of the different methods adopted for computing the national income, but he would devote the time at his disposal to a preliminary survey of the Census of Production data for 1930 and of the contribution which the material goods produced in that year made to the national income. It was his intention to make a final survey of the data in the Final Report on the Fourth Census of Production, of which two volumes had now been issued.

On the basis of the information available in the preliminary reports on the 1924 Census, Mr. Flux estimated that the net output of industry, after deduction of Excise duties in those cases in which they were included in the value of the goods produced but not in that of the materials used, amounted to £1,630 million. The final figures for 1924 indicated that this figure should be increased by about £44 million. The provisional figure used by Mr. Flux for the output of agriculture in 1924 was £292 million. This was reduced to £286 million in the Ministry of Agriculture's summary published in 1929, but Mr. Leak understood that subsequent investigation showed that the total should be somewhat larger than the provisional figure used by Mr. Flux. An addition of £2 million was also necessary on account of fisheries. These adjustments indicated that the value of the goods at the place of production or import available for distribution in 1924 would be raised from £2,635 \pm 35 million to a figure lying between £2,650 million and £2,720 million. The comparable figure arrived at by Mr. Clark, it might be noted, was £2,691 million, a figure not differing appreciably from the one based on Mr. Flux's computations.

The value of the gross output of the firms employing more than ten persons fell from £3,784 million in 1924 to £3,401 million in 1930, while the net output of these firms was about £1,549 million in the earlier and £1,500 million in the later year. The net output of the smaller firms and of the firms that made no returns was estimated

at about £125 million in 1924. The data on which to make a similar estimate for 1930 were less adequate, but so far as could be judged from such particulars as were available, it seemed probable that the net output of these firms in 1930 lay between £100 million and £110 million. It was also necessary to make allowance for the Laundry, Dry-cleaning and Dyeing Trade, omitted from the scope of the 1930 Census, and the total for that year might be estimated at about $\text{£}1,620 \pm 5$ million as compared with about £1,674 million in 1924. In order to arrive at the aggregate value of goods ready for use there must be added to these figures the total retained imports, the waste products used in industry, Customs and Excise duties, and the gross output of agriculture, fisheries and forestry. It was also necessary to add the transport and handling charges of the materials used in industry, whether imported or home-produced, while a deduction must be made for the industrial goods produced in this country or goods imported which were used as materials in agriculture and were duplicated in the value of the gross output. Finally, the value of exports must be deducted.

The value of the retained imports in 1924 was $\text{£}1,137\frac{1}{2}$ million, of which approximately £441 million represented the value of the goods ready for use. Two previous estimates as to the amount of goods ready for use included among the imports had been made—Mr. Flux gave a figure of £463 million and Mr. Clark one of £489 million. Mr. Leak's estimate did not differ widely from that of Mr. Flux, and it might not be out of place to remark that those closely associated through the Census of Production with the processes of industry might perhaps be able to recognise as raw materials, goods which might at first sight be regarded as ready for consumption. Retained imports in 1930 were valued at £957 million, of which materials for industry and agriculture amounted to about £508 million, and goods ready for use to £449 million.

Customs and Excise duties aggregated about £235 million, and there only remained to add on the industrial side the value of the waste products used in industry—roughly £12 million—and the transport and handling charges on the materials used. For 1924 two estimates of these charges had been made. Mr. Flux gave a figure of $\text{£}94 \pm 19$ million for this item, while Mr. Clark estimated it at £100 million. The two estimates confirmed each other, and Mr. Leak proposed to use Mr. Flux's basis, which gave a figure for transport and handling charges in 1930 amounting to $\text{£}76 \pm 15$ million.

The final figures for the gross output of agriculture in 1930 had not yet been published, but the information he had been able to obtain from the respective Departments showed that the aggregate value of the agricultural output in the United Kingdom in that year was about £252 million. Fisheries added £19 million and forestry about $\text{£}1\frac{1}{2}$ million, and the value of the produce of small holdings and market gardens might be estimated very roughly as £15 million or £16 million. The total value of the output of agriculture, fisheries, etc. was thus about £288 million. The goods made in industrial establishments in this country and used as materials for agriculture,

fisheries and the like were valued in 1930 at about £39 million, and this sum fell to be deducted from the aggregate.

Finally, exported goods valued at the place of production must be deducted. After allowing for the export of goods forming the waste of consumption, such as old iron, wool rags and waste-paper, and for the addition to the factory value of from 10 to 15 per cent. to cover transport and handling charges, the value of the exports might be put at £505 \pm 12 million.

The aggregate value of goods ready for use valued at the place of production or of import was thus £2,645 \pm 32 million in 1930, this total comparing with £2,685 \pm 35 million for 1924.

One advantage that the Census of Production method of estimating the national income might fairly claim over any other method was that it did enable a rough estimate to be made as to the proportion of the change between two years which might be attributed to changes in the average values of the goods produced. Quantities were obtained at the Census of Production for a very large proportion of the total goods made for sale in a given year, and quantities were also available for a large proportion of the retained imports. The price changes between two years in which a Census of Production was taken could thus be estimated approximately. The complete figures for all trades in 1930 were not yet available, but the results, so far as they went, showed that goods valued at £3,084 million in 1924 would be valued at about £2,560 million at 1930 prices, showing a fall in average value amounting to about 17 per cent. A calculation made in this way was based upon the quantities recorded at the 1924 Census. In view of the heavy decline in average values of textiles in relation to other products, and to the reduced importance of textiles in the later year, the calculation had been reworked for the total of each trade on the basis of 1924 prices, *i.e.* using as multipliers the quantities recorded in 1930. The result was not very widely different, a fall of about 16 per cent. in average values being recorded as against 17 per cent. using the quantities in 1924 as multipliers.

These results were not necessarily applicable to the total of industrial goods ready for use, and some other indices would be examined. The Board of Trade index-number of wholesale prices showed a fall of 28.1 per cent. in 1930 compared with 1924. For 1929 the decline in prices as shown by this index-number was only 17.9 per cent. Seeing that the commodities, prices of which were used for the wholesale prices index, consisted in the main of primary products, this index-number was clearly an unreliable guide as to the prices of goods ready for use. It might be of interest to note, however, that between 1924 and 1929 there was a certain consistency between the fall in wholesale prices and the fall in average values of exports, the two indices differing over that period by only 2 per cent.

While the index of average values of exports was affected by the make-up of the exports, its variations would tend to be more closely in accord with the fall in prices of goods ready for consumption than were the variations in the wholesale prices index-number. For the total of goods exported, average values in 1930 were 17.2 per cent. below those in 1924, using 1924 quantities as multipliers; for manu-

factured articles the fall was 17·0 per cent., and for food, drink and tobacco, 14·4 per cent. These falls in average values were akin to the fall of some 16 or 17 per cent. ascertained from the Census of Production records. The make-up of the two was dissimilar, but both were alike in including as well as goods ready for use, materials on which further manufacturing processes were necessary.

The value of retained imports of goods other than materials for industry and agriculture was about £444 million in 1924. These goods had been revalued at the average values recorded for goods of the same description in 1930 and the result was to show a fall in average values amounting to between 18 and 19 per cent. It might be noted, *en passant*, that imported goods ready for consumption were some 24 per cent. greater in 1930 than in 1924.

The products of agriculture in England and Wales had likewise been revalued and the decline in average value in that case amounted to 17 per cent. For fish the decline was smaller—9 per cent.

In the total of £2,685 million for 1924, taking the middle figure, it was possible to revalue directly at 1930 prices the retained imports used as materials in industry, and the value of the output of agriculture, fisheries and the like. An allowance must, however, be made for the retained imports used in making goods for export. Mr. Flux calculated that in 1924, 27 per cent. of the goods made were exported, but a similar proportion of the imported materials for industry would not necessarily have been used in making goods for export. Possibly a slightly smaller proportion might be applicable in view of the value of the exports of raw materials produced in this country, though it should be noted that even in the case of coal, imported materials in the shape of pit props were necessary. Mr. Leak said he had taken 25 per cent. as an approximate figure, but it made no appreciable difference to the final result if this were modified by 5 per cent. in either direction. A total of £829 million for agriculture, etc. and for imported industrial materials was thus reduced to £616 million. For the remaining £1,856 million, consisting as it did primarily of net output (of which about half was wages), Customs and Excise duties, and transport charges, a much smaller fall in 1930 compared with 1924 was indicated. A fall of 10 per cent. in this figure would mean that the industrial goods ready for use fell in average value by 14½ per cent., while a fall of 5 per cent. would correspond to a fall of rather less than 11 per cent. in respect of goods ready for use. Having regard to the heavy fall in the price of raw materials in the course of the year 1930, the semi-finished products of industry were likely to have declined in price during that year to a greater degree than the goods ready for consumption. For the total the fall in price was some 16 or 17 per cent., and Mr. Leak was disposed to suggest that for the goods ready for use the fall in average values was probably not more than 13 per cent. On this basis the £1,856 million would be reduced to £1,765 ± 35 million, and the aggregate of £2,685 million to, say, £2,380 ± 70 million, which compared with the total of £2,645 ± 32 million in respect of goods ready for consumption in 1930.

The increase shown by these figures was 10 ± 4 per cent. The

range was rather large and could probably be narrowed by 2 per cent. on either side. The increase in population between 1924 and 1930 was 2.5 per cent. It would therefore appear that there was available for consumption by each person in the United Kingdom on the average a quantity of goods greater in 1930 than in 1924 by between 6 and 10 per cent. It did not follow that all these extra goods were consumed in the year.

While this increase might appear at first sight rather large, it should be borne in mind that the volume of retained imports was 13½ per cent. more in 1930 than in 1924, that the production of home agriculture and fisheries increased, that the index of industrial production showed an increase of over 3 per cent. and, most important, that the volume of exports declined by 14 per cent. The combination of the last two items would indicate an increase of about 10 per cent. in industrial production for home consumption, and it was possible that the Index of Production might understate the actual increase in production which took place, as it did not take account of any important part of the output of the building industry, and that increased conspicuously between 1924 and 1930.

It might be asked whether the position as regards goods available for consumption was better or worse in 1933 than in 1930. No precise determination was at present practicable and the changed make-up of retained imports resulting from the tariff made it impossible to hazard a guess based on the formulæ given in Mr. Flux's paper. Some appreciation of the position could, however, be obtained from consideration of the available data for 1933 corresponding to those which had been given for 1930. Retained imports which, after allowing for the materials used in making exported goods, formed in 1930 about one-third of the total value of goods ready for consumption were about 8 per cent. less in 1933 than in 1930. As to agriculture, there was a larger output in 1933 than in 1932 of milk and dairy products and also of live-stock products, while wheat production and some other important crops were also larger last year than in 1930. Fisheries produced nearly 15 per cent. less than in 1930. Industrial production decreased by rather less than 5 per cent., while the volume of exports was smaller by between 21 and 22 per cent. The decline in production was substantially that necessitated by the reduction in exports, and so far as industrial goods made in this country for home consumption were concerned, it was probable that any change between 1930 and 1933 was of small magnitude. The question, therefore, seemed to turn on whether the increase in agriculture and probably in building was sufficient to offset the decreased volume of retained imports. The deficiency in retained imports at 1930 prices was nearly £80 million, and to make this good by increased agricultural production would involve an increase in the latter of about 30 per cent.

MR. COLIN CLARK felt that the most important things to be said on this subject had already been said by Professor Bowley, Sir Josiah Stamp and Mr. Leak, and he had only a few rather disjointed remarks to make. This branch of knowledge was now becoming one

of those where a great mass of detail was of more importance now that general principles were largely established. He wished to begin by underlining what Sir Josiah Stamp had said in his paper relating to the question of the valuation of stocks of goods. He believed that quantitatively it was of greater importance than was sometimes realized. Canada was a country for which a complete census of all stocks was taken a few years ago, industry, agriculture, and the distributive trades. If conditions in this country were at all comparable it must be concluded that the amount of stocks or working capital on the average represented something like £100 per occupied person. That meant that in some years, as for instance in 1933, in which there was an increase in employment of nearly 600,000, there might be changes in working capital of great magnitude. In other years, such as in 1930, when the price of commodities fell by approximately 30 per cent., the apparent change in the national income brought about by the lower valuation of these stocks in trading accounts would be of a very large order. One of the advantages of the Census of Production method of determining income was that it was not affected by this disturbing feature. The Census of Production regarded goods added to stock as sold, and goods drawn from stock were counted as purchases. This might lead to important discrepancies in a number of years between incomes recorded in this way and those recorded by the Inland Revenue. He had heard conflicting accounts about the methods used for making up accounts for income tax assessments. It had been said in the Society that the trader could make up his accounts valuing his stock at cost or current prices, whichever were the lower, and he had been told by accountants that that was the usual practice, although he had been told in the Inland Revenue that the trader was not allowed to chop and change from year to year when occasion demanded. Generally, there was a big amount deducted from income in years of falling prices, and no corresponding amount added in years of rising prices.

In general the stage had nearly been reached where it was possible to get a really adequate reckoning for the more important countries of the world from the output as well as from the income side of the whole national income or production. For Britain the figures for 1924 and 1930 obtained by the two methods could be more or less checked up, bearing in mind the fact that 1930 was a year of violent price change, and that the revaluation of stocks might make a difference of magnitude up to some £250 million. The small decline since 1924 referred to by Mr. Leak in the figures of the value of goods available for use thus corresponded with a moderate decline in profits between these two years recorded by the Inland Revenue.

One understood that in the United States and Germany double reckonings could now be made which approximately confirmed each other, although in the documents published so far and in the book of Professor King, it was rather difficult to see how the United States estimate had been built up, especially on the output side. This question was becoming more difficult from year to year as the relative importance of non-industrial output increased in this and other

countries. In 1924 the net value of industrial and agricultural output was only 50 per cent. of the gross national income, and in 1930 about 43 per cent. In America the corresponding headings covered 40 per cent. of the national income in 1929 and as little as 26 per cent in 1932. The measurement of the quantity, price or any other factors relating to non-industrial income was exceedingly difficult. On the other hand, the back of the problem was broken when one had fairly complete statistics of retail sales. The present was an exciting period when this information would all shortly be assembled. The gross value of distributive work, *i.e.* the value added to goods by the process of wholesale and retail distribution, was of an order of magnitude of some £650 million per annum, and when that figure could be firmly established and it was possible to have some idea of the change from year to year, one could have a fairly complete knowledge of output. There were different ways by which this problem could be approached; certain investigators had attempted to estimate it from average selling margins and others from the numbers of different types of shops. As far as could be seen it appeared that the various methods confirmed each other.

There was still a great deal of work to be done in establishing the incomes, or anything approaching a knowledge of the incomes, of small independent traders, particularly those in the non-industrial forms of occupation—not only of small shopkeepers but also of window-cleaners, chimney-sweeps and all the many small miscellaneous occupations which in the aggregate accounted for a considerable output. Mr. Clark could not see any way in which this could be done except by sampling. There was a large amount of miscellaneous material being collected by social surveys and in other ways, and by market research investigators in the retail trade.

These non-industrial forms of output which gave so much trouble in the estimation of the national income would give equal trouble in the estimation of the general price index. Mr. Leak had given the ingredients for the major part of what could for the first time be called a true general price index, and when supplemented by information about building and transport costs, an approach would be made towards covering the whole of material output, but it still remained necessary to try and estimate changes of prices in the non-industrial part of the national income. Pioneer work in this connection had been done by a small Committee of the Royal Statistical Society some years ago, but as far as Mr. Clark was aware, none was being carried out at the present time.

There were two other points on which information was not at present fully complete. The first was the income of wage-earners. This could be estimated fairly closely for 1924 and 1930, but there again the field of industry only covered 6 millions out of a population contributing to Health Insurance of 18 millions, and there were large numbers of non-industrial workers (including partially employed workers in domestic service and elsewhere) who had to be accounted for. Even in the field of industry, when attempts were made to carry the estimates forward from the base date, although there was

accurate knowledge of the numbers working, there was very little knowledge of the amount of short-time working, excepting for a few industries and a few years. This might make a big difference in the estimates.

The other point was in relation to profits. There some fairly complete compilations existed of the available information. These had been made by Sir Josiah Stamp and were now being kept up to date, but there was need for some form of re-sampling of the figures provided by the *Economist*. For purposes of estimating the national income the *Economist* sample did seem to be seriously misweighted and to give too much emphasis to certain speculative industries and certain forms of overseas enterprise, and to under-weight rather seriously the comparable stable industries and profits. On the other hand, when one tried to sample profits it was very clear that the range of dispersion was enormous. Dr. Coates's figures for 1922 in the Colwyn Report showed that clearly, and it was necessary to take an enormous sample in order to get any form of reliable result. At the same time, it was a field worthy of investigation.

SIR GEORGE PAISH said he would like to ask a question that had no relevance to the paper. He was himself considering how it would be possible to make comparisons in a few years from now, with the pound at present at a depression of 33 or 37 per cent.? How could proper comparisons be made of the nation's income on a gold basis and on a currency basis? When he had tried to do this himself with regard to other countries—for instance, when France reduced her franc from 25 to the £ to 124 to the £, he had divided the French income by 25 and by 124 respectively in order to reduce the income in both periods to the same gold basis. Would it not be necessary to follow this procedure in calculating the gold income of this country before and after we left the gold standard? Was the real income of the country down in comparison with sterling by 37 per cent?

One of the purposes of keeping the pound down was to prevent it from being over-valued, which involved a reduction in real wages and in real interest. Therefore it would seem desirable that there should be some discussion of this matter by the experts in order that people should not be misled into thinking our income higher than it really was.

MR. MACROSTY thought that Mr. Leak had given an answer to the last question by trying to calculate the volume of goods available for distribution in 1930 as compared with 1924, and he did not think it would be possible to use any other method for getting rid of the fluctuation of the gold value of the pound. After all, what was produced or imported ready for consumption was what had formed the reward for all the people engaged in production and distribution and also in the supply of services. If it were possible to make a volume calculation taking into account movements of population, then—speaking on the spur of the moment—he thought that would give a first measure of comparison.

PROFESSOR GREENWOOD said it interested him to find that if he ceased to clean his own motor-car and hired someone else to do so, he would be increasing the national income by the amount deducted from his income to pay for this work. It was interesting to feel that one could increase the national income by indulgence in a natural feeling of laziness that came over one from time to time.

MR. F. W. PAISH said he would like to query one figure used by Mr. Colin Clark—the figure of stocks. It seemed that of the total amount of goods passing in the trade of this country the ultimate value was in the neighbourhood of something over £2,000 million, but not more than £2,500 million; therefore the rate of turnover was between two and three times a year, which seemed extraordinarily low. The analogy of Canada could not be strictly accurate in this country, because in Canada there were greater distances, causing a liability to keep much higher proportions of stock in relation to turnover than in places where it was easy to replenish the supply. That was also found in South Africa. Judging from pure observation he would have said that the rate of stock turnover was considerably higher here than would be found in a country of great distances, where a considerable portion of the goods were only received three months after order, and where it was very difficult to judge one's requirements in advance.

MR. DUDLEY W. WALTON said that he found the whole subject as incomprehensible as the higher mathematics. He had enormous difficulty in understanding what the whole thing was about and why it was being done. Why did anybody want to know the national income? The larger it was, the more would people be taxed. The less the Governments knew about it the better. Nor was he quite sure as to the meaning of "national income." He could understand the nature of personal income, plus or minus, but he could not envisage what was meant by national income. If it meant the increment from period to period of actual values of goods and chattels, that should be ascertainable in some rough-and-ready way within a margin of 15 or 20 per cent. If it meant the determination of the current money value from time to time, it seemed to him that with the fluctuation of money value this was practically impossible. According to what had been said that evening, there might be a statistical increase in the national income, and at the same time a real decrease.

The whole of the rainfall (or water income) of the Thames Valley was measured by the quantity of water that passed over Teddington Weir. Was there not something in the field of statistics that could be boiled down to a single figure, for the comparison of the increment or decrease of the national income?

Mr. Walton would like to understand this matter, but he had read the paper twice and still found it incomprehensible.

SIR JOSIAH STAMP, replying, said: I would like the last speaker to take heart. I would only tell him that twice, like patriotism, is not enough.

The subject of the paper before us to-night is "Methods used in Different Countries for Estimating National Income"; the discussion tended inevitably to limit it rather to the particular case of our own country. If that had been the subject of the paper there would have been many things I should have found space for about the home problem, but I tried to be general, and I will endeavour now to deal with the more general aspects of the question and not to get lost in those finer—though to us more interesting—points on the details of our own particular domestic calculations.

Professor Bowley very well focussed it when he said that there were three main problems still open, and there are five or six main international problems. The question of losses or gains of a capital character which it is so easy for us to dismiss has, of course, been troublesome abroad. The very day I read the paper I received the latest statement from the United States—not from the National Bureau of Economic Research, but an official document from Washington—in which this particular idea was thrown over once and for all, with a list of reasons corresponding very closely with those I had given. Professor King started this, and it has had an excellent run, but facts and circumstances have been too much for it. When one thinks of the enormous amount of labour spent year by year on computing the gains or losses in securities, the profits of which had already been included, one realizes how necessary it is to be very careful as to the hare one starts. The United States Government have thrown it over on account of the difficulty in calculating the United States Income for 1932–33. Measured by any test it showed a reduction of some 50 per cent., but when from that figure an enormous deduction for capital values was made, it would have been necessary to tell the American people that they had lived on nothing, according to the Government calculations, and it would have been impossible to persuade them to believe they had had no income at all! Probably we have heard the last of this particular problem.

Professor Bowley mentioned undistributed profits, which is a very important factor in this country, more in the United States, and less in Germany, but we are getting to know in most industrial countries a little more about it by the taking of large samples. The method of calculation by aggregates is not a good one, for it would be wrong to hold that the difference between what comes in to the individuals as such and what is earned by the business is *undistributed* profits.

The third point was concerned with the current value of stocks of goods, and that is a very important factor. Mr. Clark rightly said it is under-estimated in magnitude. Let us get this firmly in our minds. If we start over a series of years—say ten—and finish up with the price level with which we started, having had great vagaries in price levels, the successive years' results will be very different but the aggregates will be identical. The problem is that we are measuring slightly different things. In measuring the value of the product, income is not being defined in the same way. When the business man makes up his accounts he takes out the cost of his stock in hand, for he cannot take into account the profit on goods

he has not sold, but, on the method adopted, he is also making secret reserves in times of falling prices. He is protecting himself against a possible fall in the price of that stock when he sells it. It is only of importance in times of falling prices.

During the period of Excess Profits Duty in the war, the question of the enormous addition to prices of stocks and the effect when the slump in prices should arrive was being vigorously discussed. I remember how difficult it was to make ministers understand the magnitude of its effect in tax, and when I mentioned the figure of 70 or 90 millions, they could not grasp how such a thing could possibly happen. In dealing with the national stock of the country as a whole, it is possible to see that taking into account the fall in prices of 40 or 50 per cent., this was a matter of great significance. I would hesitate to say that in any recent year it has been as big as Mr. Clark makes it, but it is an important figure.

What is the difference between the Census and the accountancy profit? No one has been able to assess it in fact. There is only one way to do it, and that would be for Mr. Clark and Mr. Leak to exchange their oaths of secrecy and to pick out certain firms that have published accounts and compare them with their Census of Production returns for the same period and see what the difference really is and how it arises, particularly in reference to stocks. If we had a decent sample of that kind it would settle the matter, and I put that forward to them as a possible means of greatly helping us.

It must be remembered that in the calculations of profits the effects of foreign exchange have already come out in a large number of businesses, and been allowed for in a way that may not come into the Census. It is not only the question of quantity of stocks not sold, or their altered prices, but also the exchange values of the stocks.

Mr. Flux set forth a gallant claim that the Census of Production was really the fundamental method of measuring the national income, so that all the other methods may be "also rans." I do not want to embark on that particular discussion, but, using Marshall's analogy for value they may be called the two blades of a pair of scissors, and we should not be able to cut deeply into the subject without them both. If we want to come within a 5 per cent. range, it is almost impossible to come to it with either method alone, but with both methods there is no reason why the five or six chief industrial countries should not come within the 5 per cent. range.

Mr. Clark said that this is a subject in which we are now dealing with details. That might be true if for this country only, but not internationally. There are still great divergences of principle as well as detail. We have been discussing the international aspect and how to bring out international comparisons, but no one country is prepared to give up its own particular method. The suggestion was therefore made that each country should provide the bricks or separate portions or categories of the national income, so that any one country could build up the national income of another in its own way on its own framework. That is to say, that Hungary, which is at present giving an estimate that cannot be brought into

comparison, would consent to give us an estimate of the things to be brought in, in order that we could get out an estimate of Hungary's national income along our own lines. I believe when that is done and national incomes are categorized, it will be much easier to bring them into line and to make comparisons.

Sir George Paish questioned whether going off the gold standard and having a different range of exchanges did not make a difference to the international problem. There is no real difference in comparing estimates for England for 1924 with 1933, and those for 1889 with 1914. They are affected by internal price changes equally, without reference to how those price changes come about. The technique comparing one country with itself over a number of years has not been completely worked out, although a great deal of work has recently been done in this connection in the United States and Germany. The indices used must to a very large extent be retail or cost of living indices. There are certain sections in which indices should be "livelier," but in the main the question is, what is the income *worth* in consumption rather than income as national production, for production is only a stage towards the conception of income. Conceivably things produced might have no value as income.

When we come to the problem of comparing one country with another, it can be tackled as by the League of Nations in 1921. In their report they made a number of uses of the national incomes of different countries by indicating the relative burden of taxation, etc.—an important factor upon which much time was spent in Paris by the Dawes Committee.

How can we translate the French income into sterling with the rate of exchange? Is it sufficient to take an average rate of exchange between two countries? You will find that if we use direct rates of exchange they will give very absurd results, so that it will be seen at once, by trial and error, that that cannot be the proper way. The correct method is doubtless to get the two countries in a normal year, when both were on the gold standard, or when the purchasing power parity was the same as the gold exchanges, and then build up by internal processes the new estimate of income for the year in question and compare the two results. It is necessary to start from a year at which they were on a level, and to carry each forward to the year for which you wish to make the comparison—a much broader method than comparing by external movements. A little patience in building up a comparison *from* a year in which the countries were reasonably comparable to the year in question is advisable.

Mr. Clark refers to the fact that retail sales are important, but I have not come across a country in which the sales standard has been effectively used in compilation of the national income.

On the question of the incomes below the income tax limit, which is unimportant in Germany but important with us, I do not attach quite so much importance to the *average* income, for we can avoid a great mistake there in judging by an ordinary distribution formula or reasonable sample. I set greater store by arriving at

the numbers of people at work, which is difficult in inter-censal years.

There is one friend we miss in these discussions, who used to be right at the forefront. You will remember the old game of fitting income tax payers into houses—the wonderful performances by Chiozza Money, Mallock and others, taking all the houses of the country and fitting the richest incomes into the biggest houses and down the scale, always finding there were too many incomes or too many houses. Since the abolition of the inhabited house duty we have lost that form of amusement. I hope it may revive some time, as it was quite a good parlour game.

If we confine the subject not to our own particular troubles, but to an endeavour to get some comparability of nations, I think some good has been done by the meeting of our own Society and by working together on international statistics. If the problem had remained the same as it was ten or fifteen years ago we should practically have solved it, but as fast as we have improved our methods of solving the old problem, new additions have been made to it.

We have attained such a reasonable degree of accuracy that we may take heart in four or five of the chief countries of the world that we want to bring into comparison, and then as the data increase in the others, we can sort out the countries anew and bring more into the comparison.

I will not go into the fundamental philosophy of which Professor Greenwood has spoken. It does seem strange that if you decide to be ill you have to increase the national income by employing a doctor. Probably he will agree with that aspect more than with others.

As a result of the ballot taken during the meeting the following candidates were elected Fellows of the Society :

Samuel John Astbury, M.A.

Moses Brewins Cotsworth.

John Roberts Crichton.

The Ven. E. Francis Crosse.

Charles Vickery Drysdale, C.B., O.B.E.,

D.Sc., M.I.E.E.

Om Prasad Gupta.

Geoffrey Madan.

Jack Harry Scott Taggart.

Edgar Brooke Timney, B.Sc.

John Turnbull, F.A.S., A.I.A.

ON THE TWO DIFFERENT ASPECTS OF THE REPRESENTATIVE METHOD :
THE METHOD OF STRATIFIED SAMPLING AND THE METHOD
OF PURPOSIVE SELECTION.

By JERZY NEYMAN

(Biometric Laboratory, Nencki Institute, Soc. Sci. Lit.
Varsoviensis, Warsaw).

[Read before the Royal Statistical Society, June 19th, 1934, the PRESIDENT,
the RT. HON. LORD MESTON of Agra and Dunottar, K.C.S.I., LL.D.,
in the Chair.]

CONTENTS.

	PAGE
I. <i>Introductory</i>	558
II. <i>Mathematical Theorems underlying the Representative Method</i> ...	561
1. The theory of probabilities <i>a posteriori</i> and the work of R. A. Fisher	561
2. The choice of the estimates	563
III. <i>Different Aspects of the Representative Method</i>	567
1. The method of random sampling	567
2. The method of purposive selection	570
IV. <i>Comparison of the two Methods of Sampling</i>	573
1. The estimates of Bowley and of Gini and Galvani	573
2. The hypotheses underlying both methods and the conditions of practical work... ..	576
3. Numerical illustration	583
V. <i>Conclusions</i>	585
VI. <i>Appendix</i>	589

I. INTRODUCTORY.

OWING to the work of the International Statistical Institute,* and perhaps still more to personal achievements of Professor A. L. Bowley, the theory and the possibility of practical applications of the representative method has attracted the attention of many statisticians in different countries. Very probably this popularity of the representative method is also partly due to the general crisis, to the scarcity of money and to the necessity of carrying out statistical investigations connected with social life in a somewhat hasty way. The results are wanted in some few months, sometimes in a few weeks after the beginning of the work, and there is neither time nor money for an exhaustive research.

But I think that if practical statistics has acquired something

* See "The Report on the Representative Method in Statistics" by A. Jensen, *Bull. Inst. Intern. Stat.*, XXII. 1^{re} Livr.

nation. In the representative method, this is due primarily to sampling. A. L. Bowley, who not only was one of the first to apply a method in practice,* but also wrote a very fundamental memoir† purporting the theory of the method. Since then the representative method has been often applied in different countries and for different purposes.

My chief topic being the theory of the representative method, I shall not go into its history and shall not quote the examples of its practical application however important—unless I find that their consideration might be useful as an illustration of some points of the theory.

There are two different aspects of the representative method. One of them is called the method of random sampling and the other the method of purposive selection. This is a division into two very broad groups and each of these may be further subdivided. The two kinds of method were discussed by A. L. Bowley in his book, in which they are treated as it were on equal terms, as being equally to be recommended. Much the same attitude has been expressed in the Report of the Commission appointed by the International Statistical Institute for the purpose of studying the application of the Representative Method in Statistics.‡ The Report says: "In the selection of that part of the material which is to be the object of direct investigation, one or the other of the following two principles can be adopted: in certain instances it will be possible to make use of a combination of both principles. The one principle is characterized by the fact that the units which are to be included in the sample are selected at random. This method is only applicable where the circumstances make it possible to give every single unit an equal chance of inclusion in the sample. The other principle consists in the samples being made up by purposive selection of groups of units which it is presumed will give the sample the same characteristics as the whole. There will be especial reason for preferring this method, where the material differs with respect to composition from the kind of material which is the basis of the experience of games of chance, and where it is therefore difficult or even impossible to comply with the aforesaid condition for the application of selection at random. Each of these two methods has certain advantages and certain defects. . . ."

This was published in 1926. In November of the same year

* A. L. Bowley: "Working Class Households in Reading." *J.R.S.S.*, June, 1913.

† A. L. Bowley: "Measurement of the Precision Attained in Sampling." Memorandum published by the Int. Stat. Inst., *Bull. Int. Stat. Inst.*, Vol. XXII. 1^{ère} Livr.

‡ *Bull. Int. Stat. Inst.*, XXII. 1^{ère} Livr. p. 376.

inter alia, on some quite arbitrary hypotheses concerning the probabilities *a priori*, and Professor Bowley accompanies his results with the following remark: "It is to be emphasized that the inference thus formulated is based on assumptions that are difficult to verify and which are not applicable in all cases."

However, since Bowley's book was written, an approach to problems of this type has been suggested by Professor R. A. Fisher which removes the difficulties involved in the lack of knowledge of the *a priori* probability law.* Unfortunately the papers referred to have been misunderstood and the validity of statements they contain formally questioned. This I think is due largely to the very condensed form of explaining ideas used by R. A. Fisher, and perhaps also to a somewhat difficult method of attacking the problem. Avoiding the necessity of appeals to the somewhat vague statements based on probabilities *a posteriori*, Fisher's theory becomes, I think, the very basis of the theory of representative method. In Note I in the Appendix I have described its main lines in a way somewhat different from that followed by Fisher.

The possibility of solving the problems of statistical estimation independently from any knowledge of the *a priori* probability laws, discovered by R. A. Fisher, makes it superfluous to make any appeals to the Bayes' theorem.

The whole procedure consists really in solving the problems which Professor Bowley termed direct problems: given a hypothetical population, to find the distribution of certain characters in repeated samples. If this problem is solved, then the solution of the other problem, which takes the place of the problem of inverse probability, can be shown to follow.

The form of this solution consists in determining certain intervals, which I propose to call the confidence intervals (see Note I), in which we may assume are contained the values of the estimated characters of the population, the probability of an error in a statement of this sort being equal to or less than $1 - \epsilon$, where ϵ is any number $0 < \epsilon < 1$, chosen in advance. The number ϵ I call the confidence coefficient. It is important to note that the methods of estimating, particularly in the case of large samples, resulting from the work of Fisher, are often precisely the same as those which are already in common use. Thus the new solution of the problems of estimation consists mainly in a rigorous justification of what has been generally considered correct more or less on intuitive grounds.†

* R. A. Fisher: *Proc. Camb. Phil. Soc.*, Vol. XXVI, Part 4, Vol. XXVIII, Part 3, and *Proc. Roy. Soc.*, A. Vol. CXXXIX.

† I regret that the necessarily limited size of the paper does not allow me to go into the details of this important question. It has been largely studied by R. A. Fisher. His results in this respect form a theory which he calls the

Here I should like to quote the words of Laplace, that the theory of probability is in fact but the good common sense which is reduced to formula. It is able to express in exact terms what the sound mind feels by a sort of instinct, sometimes without being able to give good reasons for their beliefs.

2. The Choice of the Estimates.

However, it may be observed that there remains the question of the choice of the collective characters of the samples which would be most suitable for the purpose of the construction of confidence intervals and thus for the purposes of estimation. The requirements with regard to these characters in practical statistics could be formulated as follows:

1. They must follow a frequency distribution which is already tabulated or may be easily calculated.
2. The resulting confidence intervals should be as narrow as possible.

The first of these requirements is somewhat opportunistic, but I believe as far as the practical work is concerned this condition should be borne in mind.*

Collective characters of the samples which satisfy both conditions quoted above and which may be used in the most common cases, are supplied by the elegant method of A. A. Markoff,† used by him when

Theory of Estimation. The above-mentioned problems of confidence intervals are considered by R. A. Fisher as something like an additional chapter to the Theory of Estimation, being perhaps of minor importance. However, I do not agree in this respect with Professor Fisher. I am inclined to think that the importance of his achievements in the two fields is in a relation which is inverse to what he thinks himself. The solution of the problem which I described as the problem of confidence intervals has been sought by the greatest minds since the work of Bayes 150 years ago. Any recent book on the theory of probability includes large sections concerning this problem. These sections are crowded with all sorts of "paradoxes," etc. The present solution means, I think, not less than a revolution in the theory of statistics. On the other hand, the problem of the choice of estimates has—as far as I can see—mainly a practical importance. If this is not properly solved (granting that the problem of confidence intervals has been solved correctly) the resulting confidence intervals will be unnecessarily broad, but our statements about the values of estimated collective characters will still remain correct. Thus I think that the problems of the choice of the estimates are rather the technical problems, which, of course, are extremely important from the point of view of practical work, but the importance of which cannot be compared with the importance of the other results of R. A. Fisher, concerning the very basis of the modern statistical theory. These are, of course, "qualifying judgments," which may be defended and may be attacked, but which anyone may accept or reject, according to his personal point of view and the perspective on the theory of statistics.

* The position is a different one if we consider the question from the point of view of the theory. Here I have to mention the important papers of R. A. Fisher on the theory of likelihood.

† A. A. Markoff: *Calculus of Probabilities*. Russian. Edition IV, Moscow 1923. There was a German edition of this book, Leipzig 1912, actually out of print.

dealing with the theory of least squares. The method is not a new one, but as it was published in Russian it is not generally known.* This method, combined with some results of R. A. Fisher and of E. S. Pearson concerning the extension of "Student's" distribution allows us to build up the theory of different aspects of representative method to the last details.

Suppose θ is a certain collective character of a population π and

$$x_1, x_2, \dots x_n \dots \dots \dots (1)$$

is the sample from this population. We shall say that a function of these x 's, say

$$\theta' = \theta'(x_1, x_2, \dots x_n) \dots \dots \dots (2)$$

is a "mathematical expectation estimate"† of θ , if the mean value of θ' in repeated samples is equal to θ . Further, we shall say that the estimate θ' is the best linear estimate of θ if it is linear with regard to x 's, i.e.

$$\theta' = \lambda_1 x_1 + \lambda_2 x_2 + \dots + \lambda_n x_n + \lambda_0 \dots \dots (3)$$

and if its standard error is less than the standard error of any other linear estimate of θ .

Of course, in using the words "best estimate" I do not mean that the estimate defined has unequivocal advantages over all others. This is only a convention and, as long as the definition is borne in mind, will not cause any misunderstanding. Still, the best linear estimates have some important advantages:

1. If n be large, their distribution practically always follows closely the normal law of frequency. This is important, as in applying the representative method in social and economic statistics we are commonly dealing with very large samples.

2. In most cases they are easily found by applying Markoff's method.

3. The same method provides us with the estimate of their standard errors.

4. If the estimate θ' of θ is a linear estimate, and if μ is the estimate of its standard error, then, in cases when the sampled population is normally distributed, the ratio

$$t = \frac{\theta' - \theta}{\mu} \dots \dots \dots (4)$$

follows the "Student's" distribution, which is dependent only upon the size of the sample. This is the result due to R. A.

* I doubt, for example, whether it was known to Bowley and to Gini and Galvani when they wrote their papers.

† Only the estimates of this kind will we consider below.

Fisher. Moreover, R. A. Fisher has provided tables giving the values of t such that the probability of their being exceeded by $|\theta' - \theta|/\mu$ has definite values such as .01, .02, . . . etc. This table * was published long before any paper dealing with the solution of the problem of estimation independent of the probabilities *a priori*. However, this solution is already contained in the table. In fact it leads directly to the construction of the confidence intervals. Suppose the confidence coefficient chosen is $\varepsilon = .99$. Obtain from Fisher's table the value of t , say t_ε , corresponding to the size of the sample we deal with and to a probability of its being exceeded by $|\theta' - \theta|/\mu$ equal to $1 - \varepsilon = .01$. It may then be easily shown that the confidence interval, corresponding to the coefficient $\varepsilon = .99$ and to the observed values of θ' and μ , will be given by the inequality

$$\theta' - \mu t_\varepsilon \leq \theta \leq \theta' + \mu t_\varepsilon (5)$$

5. The previous statement is rigorously true if the distribution of the x 's is normal. But, as it has been experimentally shown by E. S. Pearson,† the above result is very approximately true for various linear estimates by fairly skew distributions, provided the sample dealt with is not exceedingly small, say not smaller than of 15 individuals. Obviously, when applying the representative method to social problems this is a limitation of no importance. In fact, if the samples are very large, the best linear estimates follow the normal law of frequency, and the multiplier t_ε in the formula giving the confidence interval may be found from any table of the normal integral.‡

The above properties of the linear estimates make them exceedingly valuable from the point of view of their use in applying the representative method. I proceed now to the Markoff method of finding the best linear estimates.

This may be applied under the following conditions, which are frequently satisfied in practical work.

Suppose we are dealing with k populations,

$$\pi_1, \pi_2, . . . \pi_k (6)$$

from which we may draw random samples. Let

$$x_{i1}, x_{i2}, . . . x_{mi} (7)$$

be a sample, Σ_i , of n_i individuals randomly drawn (with replacement or not) from the population π_i . Let A_i be the mean of the

* R. A. Fisher: *Statistical Methods for Research Workers*, London, 1932, Edition IV.

† This *Journal*, Vol. XCVI, Part I.

‡ For example, Table I of the Pearson's Tables for Statisticians and Biometricians, Part I, may be used.

population π_i . We have now to make some assumption about the variances, σ_i^2 , of the populations π_i . The actual knowledge of these variances is not required. But we must know numbers which are proportional to σ_i^2 . Thus we shall assume that

$$\sigma_i^2 = \frac{\sigma_0^2}{P_i} \quad . \quad . \quad . \quad . \quad . \quad . \quad (8)$$

σ_0^2 being an unknown factor, and P_i a known number.* It would be a special case of the above conditions if it were known that

$$\sigma_1 = \sigma_2 = \dots = \sigma_k \quad . \quad . \quad . \quad . \quad . \quad (9)$$

the common value of the σ 's being unknown.

Suppose now we are interested in the values of one or several collective characters of the populations, π_i , each of them being a linear function of the means of these populations, say

$$\theta_j = a_{j1}A_1 + a_{j2}A_2 + \dots + a_{jk}A_k \quad . \quad . \quad (10)$$

where the a 's are some known coefficients. Markoff gives now the method of finding linear functions of the x 's determined by samples from all the populations, namely,

$$\begin{aligned} \theta'_j = & \lambda_{11}x_{11} + \lambda_{12}x_{12} + \dots + \lambda_{1n_1}x_{1n_1} + \\ & + \dots + \dots + \dots + \dots + \dots + \\ & + \lambda_{k1}x_{k1} + \lambda_{k2}x_{k2} + \dots + \lambda_{kn_k}x_{kn_k} \end{aligned} \quad . \quad (11)$$

such, that whatever the value of unknown θ_j :

(a) Mean θ'_j in repeated samples = θ_j .

(b) Standard error of θ'_j is less than that of any other linear function, satisfying (a).

The details concerning this method are given in Note II of the Appendix.

It is worth considering the statistical meaning of the two conditions (a), (b), when combined with the fact that if the number of observations is large, the distribution of θ' in repeated sampling tends to be, and for practical purposes is actually normal. The condition (a) means that the most frequent values of θ' will be those close to θ . Therefore, if ψ is some linear function of the x 's, which does not satisfy the condition (a), but instead the condition,

Mean ψ in repeated samples = $\theta + \Delta$, (say),

then, using ψ as an estimate of θ , we should commit systematic errors, which most frequently would be near Δ . Such estimates as ψ are called biased.

The condition (b) assures us that when using θ' 's as estimates of

* Sometimes, in special problems, even this knowledge is not required.

0's, we shall get confidence intervals corresponding to a definite confidence coefficient, narrower than those obtained using any other linear estimate. In other words, using linear estimates satisfying the conditions (a) and (b) we may be sure that we shall not commit systematic errors, and that the accuracy of the estimate will be the greatest.

III. DIFFERENT ASPECTS OF THE REPRESENTATIVE METHOD.

We may now proceed to consider the two aspects of the representative method.

1. *The Method of Random Sampling.*

The method of random sampling consists, as it is known, in taking at random elements from the population which it is intended to study. The elements compose a sample which is then studied. The results form the basis for conclusions concerning the population. The nature of the population is arbitrary. But we shall be concerned with populations of inhabitants of some country, town, etc. Let us denote this population by Π . Its elements will be single individuals, of which we shall consider a certain character x , which may be measurable or not (*i.e.* an attribute). Suppose we want to estimate the average value of the character x , say \bar{X} , in all individuals forming the population Π . It is obvious that in the case where x is an attribute, which may be possessed or not by the individuals of the population, its numerical value in these individuals will be 0 or 1, and its mean value \bar{X} will be the proportion of the individuals having actually the attribute x .

The method of random sampling may be of several types :

(a) The sample, Σ , which we draw to estimate \bar{X} is obtained by taking at random single individuals from the population Π . The method of sampling may be either that with replacement or not. This type has been called by Professor Bowley that of unrestricted sampling.

(b) Before drawing the random sample from the population Π this is divided into several "strata," say

$$\Pi_1, \Pi_2, \dots \Pi_k \quad . \quad . \quad . \quad . \quad . \quad . \quad (12)$$

and the sample Σ is composed of k partial samples, say

$$\Sigma_1, \Sigma_2, \dots \Sigma_k \quad . \quad . \quad . \quad . \quad . \quad . \quad (13)$$

each being drawn (with replacement or not) from one or other of the strata. This method has been called by Professor Bowley the method of stratified sampling. Professor Bowley considered only the case when the sizes, say, m'_i , of the partial samples are pro-

portionate to the sizes of corresponding strata. I do not think that this restriction is necessary and shall consider the case when the sizes of the strata, say

$$M'_1, M'_2, \dots M'_k \dots \dots \dots (14)$$

and the sizes of partial samples, say

$$m'_1, m'_2, \dots m'_k \dots \dots \dots (15)$$

are arbitrary.

In many practical cases the types of sampling described above cannot be applied. Random sampling means the method of including in the sample single elements of the population with equal chances for each element. Human populations are rarely spread in single individuals. Mostly they are grouped. There are certainly exceptions. For instance, when we consider the population of insured persons, they may appear in books of the insurance offices as single units. This circumstance has been used among others by A. B. Hill,* who studied sickness of textile workers, using a random sample of persons insured in certain Approved Societies. But these cases are rather the exceptions. The process of sampling is easier when the population from which we want a sample to be drawn is not a population of persons who are living miles apart, but some population of cards or sheets of paper on which are recorded the data concerning the persons. But even in this simplified position we rarely find ungrouped data. Mostly, for instance when we have to take a sample from the general census data, these are grouped in some way or other, and it is exceedingly difficult to secure an equal chance for each individual to be included in the sample. The grouping of the general census data—for the sake of definiteness we shall bear this example in mind—has generally several grades. The lowest grade consists perhaps in groupings according to lodgings: the inhabitants of one apartment are given a single sheet. The next grouping may include sheets corresponding to apartments in several neighbouring houses † visited by the same officer collecting the data for the Census. These groups are then grouped again and again. Obviously it would be practically impossible to sample at random single individuals from data subject to such complex groupings. Therefore it is useful to consider some further types of the random sampling method.

(c) Suppose that the population Π of M' individuals is grouped into M_0 groups. Instead of considering the population Π we may

* A. B. Hill: *Sickness amongst Operatives in Lancashire Cotton Spinning Mills*, London 1930.

† This was the grouping used in the Polish General Census in 1931. The corresponding groups will be called "statistical districts." The number of persons in one statistical district varied from 30 to about 500.

now consider another population, say π , having for its elements the M_0 groups of individuals, into which the population Π is divided. Turning to the example of the Polish Census, in which the material has been kept in bundles, containing data from single statistical districts, it was possible to substitute the study of the population π of $M_0 = 123,383$ statistical districts, for the study of the population Π of $M' = 32$ million individuals. If there are enormous difficulties in sampling individuals at random, these difficulties may be greatly diminished when we adopt groups as the elements of sampling. This being so, it is necessary to consider, whether and how our original problem of estimating X , the average value of the character x of individuals forming the population Π , may be transformed into a problem concerning the population π of groups of individuals.

The number we wish to estimate is

$$X = \frac{1}{M'} \sum_{i=1}^{M'} (x_i) \quad . \quad . \quad . \quad . \quad . \quad (16)$$

where x_i means the value of the character x of the i -th individual. Obviously there is no difficulty in grouping the terms of the sum on the right-hand side of the above equation so that each group of terms refers to a certain group of individuals, forming the population π . Suppose that these groups contain respectively

$$v_1, v_2, \dots, v_M \quad . \quad . \quad . \quad . \quad . \quad (17)$$

individuals and that the sums of the x 's corresponding to these individuals are

$$u_1, u_2, \dots, u_M \quad . \quad . \quad . \quad . \quad . \quad (18)$$

With this notation we shall have

$$M' = v_1 + v_2 + \dots + v_M = \Sigma(v) \quad . \quad . \quad (19)$$

$$\sum_{i=1}^{M'} (x_i) = u_1 + u_2 + \dots + u_M = \Sigma(u) \text{ (say)} \quad . \quad (20)$$

The problem of estimating X is now identical with the problem of estimating the character of the population π , namely,

$$X = \frac{\Sigma(u)}{\Sigma(v)} \quad . \quad . \quad . \quad . \quad . \quad (21)$$

We have now to distinguish two different cases: (a) the number M' of individuals forming the population Π is known, and (b) this number is not known.

In the first case the problem of estimating X reduces itself to that of estimating the sum of the u 's in the numerator of (21). In the other case we have also to estimate the sum of the v 's in the denominator and, what is more, the ratio of the two sums. Owing

to the results of S. Bernstein and of R. C. Geary this may be easily done if the estimates of both the numerator and the denominator in the formula giving X are the best linear estimates. The theorem of S. Bernstein * applies to such estimates, and states that under ordinary conditions of practical work their simultaneous distribution is representable by a normal surface with constants easy to calculate. Of course there is the limiting condition that the size of the sample must be large. The result of Geary † then makes it possible to determine the accuracy of estimation of X by means of the ratio of the separate estimates of the numerator and the denominator.

Thus we see that if it is impossible or difficult to organize a random sampling of the individuals forming the population to be studied, the difficulty may be overcome by sampling groups of individuals. Here again we may distinguish the two methods of unrestricted and of stratified sampling. It is indisputable that the latter has definite advantages both from the point of view of the accuracy of results and of the ease in performing the sampling. Therefore we shall further consider only the method of stratified sampling from the population π , the elements of which are groups of individuals forming the population Π . It is worth noting that this form of the problem is very general. It includes the problem of unrestricted sampling, as this is the special case when the number of strata $k = 1$. It includes also the problem of sampling individuals from the population Π , as an individual may be considered as a group, the size of which is $v = 1$. We shall see further on that the method of stratified sampling by groups includes as a special case the method of purposive selection.

2. *The Method of Purposive Selection.*

Professor Bowley did not consider in his book the above type (c) of the method of random sampling by groups.‡ When, therefore, he speaks about the principle of random sampling he is referring to the sampling of individuals. According to Bowley, the method of purposive selection differs from that of random sampling mainly in the circumstances that "in purposive selection the unit is an aggregate, such as a whole district, and the sample is an aggregate of these aggregates, while in random selection the unit is a person or thing, which may or may not possess an attribute, or with which some measurable quantity is associated. . . . Further, the fact that the selection is purposive very generally involves intentional dependence

* S. Bernstein: "Sur l'extension du théorème limite du calcul des probabilités," *Math. Ann.*, Bd. 97.

† R. C. Geary: "The Frequency Distribution of the Quotient of Two Normal Variates," *J.R.S.S.*, Vol. XCIII, Part III.

‡ Though he applied it in practical work.

on correlation, the correlation between the quantity sought and one or more known quantities. Consequently the most important additional investigation in this section relates to the question how far the precision of the measurements is increased by correlation, and how best an inquiry can be arranged to maximize the precision."

It is clear from this quotation that the terminology of Professor Bowley and that which I am using do not quite fit together. In fact the circumstance that the elements of sampling are not human individuals, but groups of these individuals, does not necessarily involve a negation of the randomness of the sampling. Therefore I have thought it useful to consider the special type of random sampling by groups, and the nature of the elements of sampling will not be further considered as constituting any essential difference between random sampling and purposive selection.

The words purposive selection will be used to define the method of procedure described by Bowley, Gini and Galvani. This may be divided into two parts: (a) the method of obtaining the sample, and (b) the method of estimation of such an average as \bar{X} , described above.

The method of obtaining the sample assumes that the population Π of individuals is divided into several, M , districts forming the population π , that the number of individuals in each district, say v_i , is known and, moreover, that there is known for each district the value of one or more numerical characters, which Professor Bowley calls "controls." There is no essential difference between cases where the number of controls is one or more, so we shall consider only the case where there is one control, which we shall denote by y_i for the i -th district. We shall retain our previous notation and denote by u_i the sum of values of x , corresponding to the i -th district or group. Consider next, say, $\bar{x}_i = u_i/v_i$ or the mean value of the character x in the i -th district. The basic hypothesis of the method of purposive selection is that the numbers \bar{x}_i are correlated with the control y_i and that the regression of \bar{x}_i on y_i is linear. As we shall have to refer again to this hypothesis, it will be convenient to describe it as the hypothesis H .

Assuming that the hypothesis H is true, the method of forming the sample consists in "purposive selection" of such districts for which the weighted mean

$$Y' = \frac{\Sigma(vy)}{\Sigma(v)} \quad . \quad . \quad . \quad . \quad . \quad (22)$$

has the same value, or at least as nearly the same as it is possible, as it has for the whole population, say Y . It is assumed that the above method of selection may supply a fairly representative sample, at least with regard to the character x . As it follows from the quotation from the work of Gini and Galvani, it was also believed that

multiplying the controls it would be possible to obtain what could be termed a generally representative sample with regard to many characters. Otherwise the method of purposive selection could not be applied to supply a sample which could be used in the future for purposes not originally anticipated.

This is the method of obtaining the sample. As we shall easily see, it is a special case of stratified random sampling by groups. In fact, though the three authors think of districts as of rather large groups with populations attaining sometimes one million persons, they assume that the number M of these districts is not very small. In the Italian investigation it was over 200. If we consider the values of the control, y , calculated for each district, we shall certainly find such districts for which the value of y is practically the same. Thus the districts may be grouped in strata, say of the first order

$$\pi_{y_1}, \pi_{y_2}, \dots, \pi_{y_k} \quad . \quad . \quad . \quad . \quad (23)$$

each corresponding to a given value of y . Now each of the first order strata of districts may be subdivided into several second order strata, according to the values of v in the districts. Denote by π_{yv} a stratum containing, say, M_{yv} districts, all of which have practically the same values of the control, y , and the same number of individuals v . Denote further by m_{yv} the number of the districts belonging to π_{yv} to be included in the sample. If the principle directing the selection consists only in the fulfilment of the condition that the weighted mean of the control with v 's as weights should be the same in the sample and in the population, then it means nothing but a random sampling of some m_{yv} districts from each second order stratum, the numbers m_{yv} being fixed in advance, some of them being probably zero. This is obvious, since for purposes of keeping the weighted mean $Y' = Y = \text{constant}$, two different districts belonging to the same second order stratum are of equal value. Hence we select one of them at random.*

Thus we see that the method of purposive selection consists, (a) in dividing the population of districts into second order strata according to values of y and v , and (b) in selecting randomly from each stratum a definite number of districts. The numbers of samplings

* It must be emphasized that the above interpretation of the method of purposive selection is a necessary one if we intend to treat it from the point of view of the theory of probability. There is no room for probabilities, for standard errors, etc., where there is no random variation or random sampling. Now if the districts are selected according to the corresponding values of the control y and also of the number of individuals, v , they contain, the only possible variate which is left to chance is \bar{x}_i . If the districts are very large and therefore only very few, then the majority of second order strata will contain only one district. In this case, of course, the process of random sampling in such a stratum is an imaginary one.

are determined by the condition of maintenance of the weighted average of the y . Comparing the method of purposive selection with that of stratified sampling by groups we have to bear in mind these two special features of the former.

IV. COMPARISON OF THE TWO METHODS OF SAMPLING.

1. *Estimates of Bowley and of Gini and Galvani.*

Suppose now the sample is drawn and consider the methods of estimation of the average X . In this respect the Italian statisticians do not agree with Bowley, so we shall have to consider two slightly different procedures. I could not exactly follow the method proposed by Professor Bowley. It is more clearly explained by the Italian writers, but I am not certain whether they properly understood the idea of Bowley. It consists in the following:

Denote by X_{Σ} the weighted mean of values \bar{x} , deduced from the sample, Σ ; by \bar{x} , the unweighted mean of the same numbers, also deduced from the sample. Y will denote the weighted mean of the control y , having *ex hypothesi* equal values for the sample and for the population. \bar{y} will denote the unweighted mean of the control y , calculated for the population, and finally g the coefficient of regression of \bar{x} , on y , calculated partly from the sample and partly from the population.

As a first approximation to the unknown X , X_{Σ} may be used. But it is possible to calculate a correction, K , to be subtracted from X_{Σ} so that the difference $X_{\Sigma} - K$ should be considered as the second approximation to X . The correction K is given by the formula

$$K = -(X - \bar{x}) + g(Y - \bar{y}) \quad . \quad . \quad (24)$$

As the value of X is unknown, its first approximation X_{Σ} may be substituted in its place. In this way we get as a second approximation to X the expression, say,

$$X' = X_{\Sigma} + (X_{\Sigma} - \bar{x}) - g(Y - \bar{y}) \quad . \quad . \quad (25)$$

I do not know whether this is the method by which Bowley has calculated the very accurate estimates in the examples he considers in his paper. At any rate the method as described above is inconsistent: even if applied to a sample including the whole population and even if the fundamental hypothesis H about the linearity of regression of \bar{x} , on y , is exactly satisfied, it may give wrong results:

$$X' \neq X \quad . \quad . \quad . \quad (26)$$

This may be shown on the following simple example. Suppose

that the population π consists only of four districts characterized by the values of \bar{x}_i , y_i and v_i as shown in the following Table I.

TABLE I.

Districts.	x_i .	y_i .	v_i .	$u_i = \bar{x}_i v_i$.	$y_i v_i$.
I.	·07	·09	100	7	9
II.	·09	·09	400	36	36
III.	·11	·12	100	11	12
IV.	·13	·12	900	117	108
Totals	·40	·42	1500	171	165
Means	$\bar{x} = \cdot100$	$\bar{y} = \cdot105$	—	$X = \cdot114$	$Y = \cdot110$

Owing to the fact that the control y has only two different values, ·09 and ·12, there is no question about the hypothesis H concerning the linearity of regression, which is certainly satisfied. The regression line passes through the points with co-ordinates ($y = \cdot09$, $x = \cdot08$) and ($y = \cdot12$, $x = \cdot12$). Thus the coefficient of regression $g = \frac{1}{3}$. Assume now we have a sample from the above population, which includes the whole of it and calculate the estimate X' of $X = \cdot114$. We shall have

$$\begin{aligned}
 X_{\Sigma} &= &= &\cdot114 \\
 + (X_{\Sigma} - \bar{x}) &= &= &\cdot014 \\
 - g(Y - \bar{y}) &= -\frac{\cdot02}{3} = -\cdot007 \quad . \quad . \quad (27) \\
 \hline
 X' &= \cdot121,
 \end{aligned}$$

which is not equal to $X_{\Sigma} = \cdot114$.

Gini and Galvani applied Bowley's method to estimate the average rate of natural increase of the population of Italy, using a sample of 29 out of 214 circondari. They obtained results which they judged to be unsatisfactory, and they proposed another method of estimation. This consists in the following:

They start by finding what could be called the weighted regression equation. If there are several controls, say $y^{(1)}$, $y^{(2)}$, . . . $y^{(s)}$, the weighted regression equation

$$x = b_0 + b_1 y^{(1)} + b_2 y^{(2)} + \dots + b_s y^{(s)} \quad . \quad . \quad (28)$$

is found by minimizing the sum of squares

$$\Sigma v_i (x_i - b_0 - b_1 y_i^{(1)} - \dots - b_s y_i^{(s)})^2 \quad . \quad . \quad (29)$$

with regard to the coefficients b_0 , b_1 , b_2 , . . . b_s . This process would follow from the ordinary formulæ if we assumed that one district with the number of individuals v_i and the mean character \bar{x}_i is equivalent to v_i individuals, each having the same value of the character

$x = \bar{x}_i$. Having noticed this, it is not necessary to go any further into the calculations. If there is only one control, y , then the weighted regression equation will be different from the ordinary one in that it will contain weighted sample means of both \bar{x}_i and y_i instead of the unweighted ones, and that in the formula of the regression coefficient we should get weighted instead of unweighted sums. The weighted regression equation is then used by Gini and Galvani to estimate the value of \bar{x}_i for each district, whether included in the sample or not. This is done by substituting into the equation the values of the control y_i corresponding to each district and in calculating the value of the dependent variable. The estimates of the means \bar{x}_i thus obtained, say \bar{x}_i' , are then used to calculate their weighted mean

$$X' = \frac{\sum(v_i \bar{x}_i')}{\sum(v_i)}, \quad . \quad . \quad . \quad . \quad . \quad . \quad (30)$$

which is considered as an estimate of the unknown mean X .

Simple mathematical analysis of the situation proved (see Note III) that this estimate is consistent when a special hypothesis, H' , about the linearity of regression of \bar{x}_i on y_i holds good, and even that it is the best linear estimate under an additional condition, H_1 , concerning the variation of the \bar{x}_i in strata corresponding to different fixed values of y and v .

The hypothesis H' consists in the assumption that the regression of \bar{x} on y is linear not only if we consider the whole population π of the districts, but also if we consider only districts composed of a fixed number of individuals. It is seen that the hypothesis H' is a still more limiting than the hypothesis H .

The other condition, H_1 , is as follows. Consider a stratum, π' , defined by the values $y = y'$ and $v = v'$ and consider the districts belonging to this stratum. Let

$$\bar{x}_1, \bar{x}_2, \dots, \bar{x}_p \quad . \quad . \quad . \quad . \quad . \quad . \quad (31)$$

be the values of the means \bar{x} corresponding to these districts. The hypothesis, say H_1 , under which the estimate of X proposed by Gini and Galvani is the best linear estimate, consists in the assumption that the standard deviation, say σ' of the \bar{x}_i corresponding to the stratum π' may be presented by the formula

$$\sigma = \frac{\sigma}{\sqrt{v'}} \quad . \quad . \quad . \quad . \quad . \quad . \quad (32)$$

σ being a constant, independent of the fixed value of $v = v'$. This hypothesis would be justifiable if the population of each district could be considered as a random sample of the whole population Π . In fact, then the standard deviation of means, \bar{x}_i corresponding to

districts having their population equal to v would be proportional to v^{-1} . The population of a single district is certainly not a random sample from the population of the country, so the estimate of Gini and Galvani is not the best linear estimate—at least in most cases.

Having got so far we may consider whether and to what extent there is justification for the principle of choosing the sample so that the weighted mean of the control in the sample should be equal to the weighted mean of the population. The proper criterion to use in judging seems to be the standard error of the estimate of X' . This is given by a function (see Note III) which, *ceteris paribus*, has smaller values when the weighted sample mean of the control is equal to its population value, and when the sum of weights $\Sigma(v)$, calculated for the sample, has the greatest possible value. Thus the principle of purposive selection is justified. The analysis carried out in Note III suggests also that if the number of districts to be included in the sample is fixed we should get greater accuracy by choosing larger districts rather than smaller ones. This conclusion, however, depends largely upon the assumptions made concerning the standard deviations within the districts and the linearity of regression.

2. *The Hypotheses underlying both Methods and the Conditions of Practical Work.*

We may now consider the questions: (1) Are we likely to find in practice instances where the hypotheses underlying the method of purposive selection are satisfied, namely, the hypothesis H' concerning the linearity of regression and the hypothesis H_1 concerning the variation of the character sought within the strata of second order? (2) If we find instances where these hypotheses are not satisfied exactly, then what would be the result of our ignoring this fact and applying the method of purposive selection? (3) Is it possible to get any better method than that of purposive selection? *

With regard to (1), I have no doubt that it is possible to find instances, when the regression of a certain character \bar{x} , on the control y , is fairly nearly linear. This may be the case especially when one of the characters \bar{x} and y is some linear function of the other, say if \bar{x} is the rate of natural increase of the population and y the birth-rate. This is the example considered by Gini and Galvani. I think, however, that this example is rather artificial. When y is known for any district, in most cases we shall probably have all the necessary data to enable us to compute the \bar{x} without any appeal to the representative method. In other cases, however, when the connection between the character sought and the possible control is not so straightforward, I think it is rather dangerous to assume

* *I.e.* a method which would not lose its property of being consistent when the hypothesis H' is not satisfied.

any definite hypothesis concerning the shape of the regression line. I have worked out the regression of the mean income \bar{x}_i of people inhabiting different circondari on the first of the controls used by Gini and Galvani, i.e. the birth-rate, y_i . The figures I and II give respectively the approximate spot diagram of the correlation table of those characters, and the graph of the weighted regression line of \bar{x}_i and y_i . It is to be remembered that the data concern the whole population, and thus the graph represents the "true" regression line. This is far from being straight. It is difficult, of course, to judge how often we shall meet in practice considerable divergencies from linearity. I think, however, that it is rather safer to assume that the linearity is not present in general and to consider the position when the hypothesis H' is not satisfied.

The hypothesis H_1 is probably never satisfied.

With regard to (2): Note III shows that the estimate of Gini and Galvani generally ceases to be unbiased when we can no longer make any assumption about the shape of the regression line of \bar{x} on y . It may be kept consistent only by adjusting in a very special manner the numbers of districts selected from single second order strata. In fact the consistency requires that the number of districts, say m' to be selected from a stratum containing altogether M' districts, should satisfy the condition

$$\frac{m'}{M'} = \frac{\Sigma(r) \text{ for the sample}}{\Sigma(v) \text{ for the population}} \quad . \quad . \quad . \quad (33)$$

Any departure from this rule may introduce some bias in the estimate.

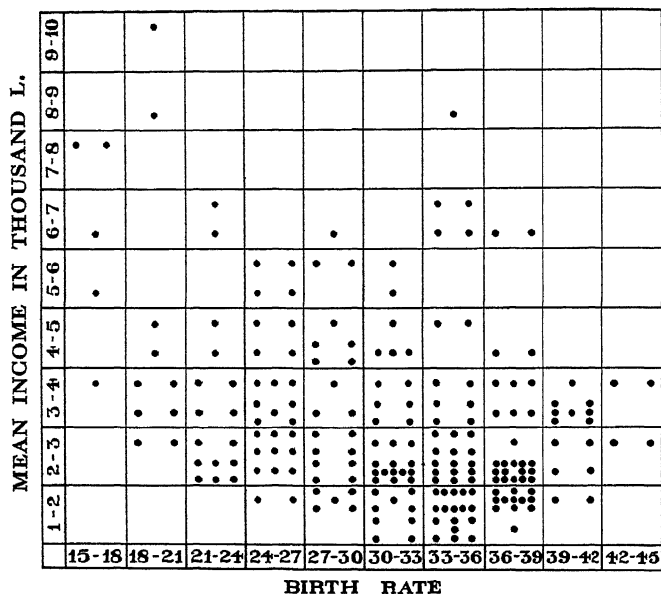
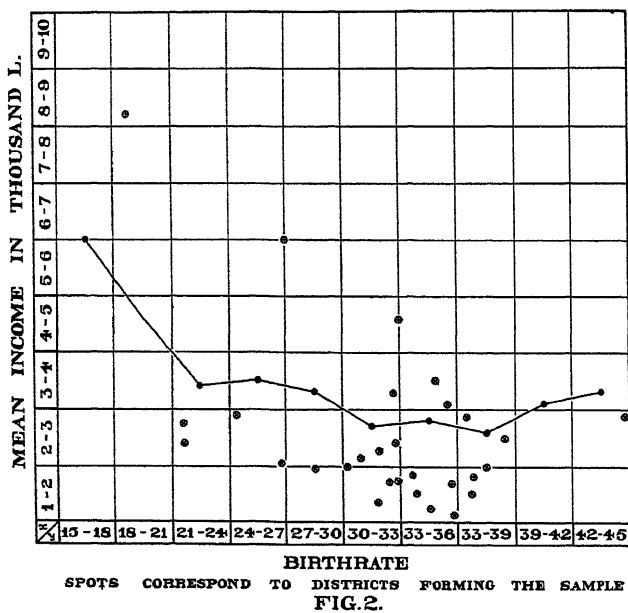
With regard to (3): There is no essential difficulty in applying Markow's method to find the best unbiased estimates of the average X determined from a sample obtained by the method of stratified sampling by groups. This has been done in full detail in my Polish publication (there is an English summary)* concerning the theory of the representative method. The principle of stratifying, i.e. of the division of the original population of districts into strata, does not affect the method of obtaining the estimate. In any case, and whatever the variances of the \bar{x}_i within the strata, the best linear estimate of X is always the same.

I shall return here to variables introduced previously and shall use

$$u_i = v_i \bar{x}_i \quad . \quad . \quad . \quad . \quad . \quad . \quad (34)$$

instead of \bar{x}_i . Suppose that in m' samplings from a stratum containing M' districts, we obtained m' different values of u . Denote by \bar{u} their arithmetic mean. Then the product $M'\bar{u}$ will be the

* J. Neyman: *An Outline of the Theory and Practice of Representative Method, Applied in Social Research*. Institute for Social Problems, Warsaw, 1933.

FIG.1.**REGRESSION OF x ON y .**

estimate of the sum of the u 's for the whole stratum. Summing these estimates for all strata, we get the best estimate of the sum of u 's for the whole population. To get an estimate of X it remains only to divide the estimate of the sum of u 's by the sum of v 's, which may be known or may be estimated by the same method. Thus the final estimate of X say X'' is either

$$X'' = \frac{\Sigma(M'\bar{u})}{\Sigma(v)} \quad . \quad . \quad . \quad . \quad . \quad (35)$$

if the v 's are known for every district, or in the other case

$$X'' = \frac{\Sigma(M'\bar{u})}{\Sigma(M'\bar{v})} \quad . \quad . \quad . \quad . \quad . \quad (36)$$

where \bar{v} means the arithmetic mean of v 's, calculated from the sample separately for each stratum.

The consistency of the estimates $\Sigma(M'\bar{u})$ and $\Sigma(M'\bar{v})$ does not depend upon any arbitrary hypothesis concerning the sampled population. The only condition, which must be satisfied is that the sample should contain districts from every stratum. So we may safely apply these estimates, whatever the properties of single strata and irrespective of variations of u 's and v 's within the strata. But the standard errors of the two estimates do depend both upon the variability of the characters of districts within the strata and upon the relationship of numbers m' and M' . It is known that the formula giving the variance, say σ^2 , of the estimate $\Sigma(M'\bar{u})$ is as follows :

$$\sigma^2 = \Sigma \left\{ \frac{M_i^2 M_i - m_i}{m_i M_i - 1} \sigma_i^2 \right\} \quad . \quad . \quad . \quad . \quad (37)$$

where m_i and M_i refer to the i -th stratum, σ_i^2 is the variance of the u 's in the i -th stratum and the summation Σ extends over all strata. The dependence of σ^2 upon the σ_i^2 is obvious. If we succeed in dividing the population π into strata which would be very homogeneous with regard to the character u of the districts, σ_i^2 will be small and so will be σ^2 . It is also obvious that by increasing the numbers, m_i , of districts to be selected from the strata we shall also improve the accuracy of the estimate. By taking $m_i = M_i$, the accuracy will be absolute, but then we shall have an exhaustive enquiry. It will probably be necessary to assume that the actual conditions of the research fix a certain number, say

$$m_0 = \Sigma(m_i) \quad . \quad . \quad . \quad . \quad . \quad (38)$$

of districts to be selected from the population. Our problem will then consist in distributing the total number of samplings among single strata so as to have the minimum possible value of σ^2 .

Simple calculations show that the variance (37) may be written in the form

$$\sigma^2 = \frac{M_0 - m_0}{m_0} \Sigma(M_i S_i^2) + \Sigma m_i \left(\frac{M_i S_i}{m_i} - \frac{\Sigma(M_i S_i)}{m_0} \right)^2 - \frac{M_0}{m_0} \Sigma M_i \left(S_i - \frac{\Sigma(M_i S_i)}{M_0} \right)^2 \quad (39)$$

where S_i^2 stands for $M_i \sigma_i^2 / (M_i - 1)$. We see that only the middle term of the right-hand side depends upon the values of the m 's. The other terms remain constant whatever the system of m 's, provided their sum, m_0 , remains unchanged. Thus the method of diminishing the value of σ^2 consists in diminishing the middle term of the right-hand side of (39). This has its minimum value, zero, when the numbers m_i are proportional to the products $M_i S_i$. Thus if it is possible to estimate the variances σ_i^2 of the u 's within any given stratum, the most favourable system of m 's is not that for which the m_i are proportional to the M_i . Denote the three terms of the right-hand side of (39) respectively by A , B and $-C$. If we assume that the m_i 's are proportional to M_i , then we shall find that the term $B = C$ and the variance σ^2 is reduced to

$$\sigma^2 = \frac{M_0 - M_0}{m_0} \Sigma(M_i S_i^2) = A \quad (40)$$

If, however, m_i are proportional to $M_i S_i$, then the positive term B in (39) vanishes and we get

$$\sigma^2 = A - C \quad (41)$$

which is the optimum value of σ^2 .

If the research is carried out with regard to several highly correlated characters of groups forming the elements of sampling, then by means of a preliminary enquiry it is possible to estimate the numbers S_i , which, if calculated for the different characters sought, would be also correlated. Hence we could then by a proper choice of the numbers m_i if not reduce the middle term of the right-hand side of (39) to zero, then at least diminish it sensibly.

Such was the case in the Warsaw enquiry already referred to, carried out by the Institute for Social Problems. The purpose of this enquiry was to describe the structure of the working class in Poland, according to different characters, such as the age distribution of males and females, whether married or single, the distribution of the number of children in families, etc., and this separately for three different categories of workers. Obviously all characters of the elements of sampling sought are highly correlated with the number of workers in each element. As there are in Poland large

districts where the percentage of workers is negligible and others where they are numerous, the numbers S_i calculated for the different characters sought varied from stratum to stratum in broad limits. Accordingly, an adjustment of numbers m_i was made in order to diminish variances of the estimates.

The necessity of these adjustments is not difficult to appreciate. One feels intuitively that it would be unreasonable to include in the sample, equal percentages of statistical districts from two strata A and B in one of which, A , the percentage of workers, amounts to say 60 per cent. and in the other, B , to 5 per cent. It may even be assumed that in such cases it would be advisable to omit totally the stratum B . However, I do not think it is really always advisable, since the total number of workers in the stratum B may be sometimes equal to or even larger than those in stratum A , and the structure of family conditions in both strata may be very different.

Of course this sort of research is a rather special one. In many cases the characters sought are not likely to be highly correlated. In other cases—as in the work of Gini and Galvani—it is impossible to state at the time of sampling which characters of the elements of sampling will be the matter of research. Any adjustments of the numbers, m_i , are then impossible, since a wrong adjustment may give to σ^2 a value larger than that corresponding to the system of proportional sampling. The best we can do is to sample proportionately to the sizes of strata.*

Thus the principle that the numbers m_i should be proportional to M_i , suggested by Professor Bowley, is just the best that one could advise in the most general case.

Up to this point I have considered the possibility of reducing the value of σ^2 by adjusting properly the numbers m_i of samplings from different strata. I assumed, in fact, that the districts forming the elements of sampling and their total number m_0 to be included in the sample are fixed. Now I shall suppose that the districts are not fixed except that their size will not be very different, and that all that is known is that the sample should include a certain percentage of districts, whatever be their kind.

In other words, I intend to consider the situation in which we decide to include in the sample some, *e.g.* 10 per cent. of the population, and are considering the question what should be our "districts," forming the elements of sampling: whether they should include about, say 200 or about 20,000 persons, etc.

I wish to call attention to the fact, that the ratios m_i/M_i , being fixed in some way or other, the value of σ^2 (see (37)) depends upon

* It is to be remembered that "the size of the stratum" is the number, M_i , of its elements, not the number of individuals.

the products $M_i S_i^2 = M_i^2 \sigma_i^2 / (M_i - 1)$, or practically upon the products $M_i \sigma_i^2$, and may be influenced by a proper choice of the element of sampling. In fact, if we consider two different systems of division of a stratum into larger and smaller districts, then the values of u 's corresponding to several smaller districts forming a larger one, will be very generally positively correlated. As the result of this the value of $M_i \sigma_i^2$, corresponding to a subdivision of strata into smaller districts, will be less than that corresponding to a subdivision into larger districts. This point may be illustrated on an extreme case. Suppose, for instance, that X represents the proportion of agricultural workers aged 20 to 21. Then for every individual of the population x will have the value $x = 1$ if this individual is an agricultural worker aged 20 to 21, and $x = 0$ in all other cases. If now we consider as elements of sampling the statistical districts including 50 inhabitants, then in a stratum we may have (in the most unfavourable case) one half of the districts composed only of agricultural workers at the fixed age, thus having $u = 50$, while in the other half of the district $u = 0$. The standard deviation σ_i would be 25. On the other hand, if the districts were to include not 50 persons, but, say, 500, the maximum possible value of σ_i would be tenfold, 250. The term $M_i \sigma_i^2$ in this second case would be ten times larger than in the former. Of course it may be argued that taking larger districts we decrease the chance of their being extremely differentiated. This is certainly so, but on the other hand I think it extremely probable that the products $M_i S_i^2$ calculated for districts including tens of thousands or hundreds of thousands of people must be expected to be incomparably larger than those calculated for the districts including on the average two or three hundred people. And this for the majority of imaginable characters which could be the matter of statistical research.*

The effect of choosing smaller units of sampling may be roughly illustrated on another example of a game of chance, in which the probability of a gain is equal to $\frac{1}{2}$. Suppose we dispose of a sum of £100 for the game, which we may either bet at once or divide in a hundred separate bettings. In the first case it is obviously impossible to predict the result. In the other case, however, we may

* I do not know whether these were the reasons for which Gini and Galvani expressed the view that the results of their sampling would have been much better if the method of selection adopted were that of stratified sampling, and if the element of sampling were a commune. The reasons for not applying this method seems to be that "nobody could under-appreciate the difficulty in a stratification of the communes simultaneously with regard to different characters." (Page 6, *loc. cit.*). I think, however, that a stratification assuming the 214 circondari as strata, each containing about 40 communes, which might be considered as elements of sampling, would be quite sufficient. Of course the results would be probably still better if the elements of sampling were smaller than a commune.

be pretty certain that the gain or loss will not exceed some £15 or £20.

Similarly, if we want to obtain a representative sample, say amounting to 15 per cent. of the population, it is much safer to make, say, 3,000 samplings of small units rather than 30 of larger ones, and this is probably true, whatever the stratification.

3. Numerical Illustration.

It may be perhaps useful to consider a simple numerical example showing the effect on the accuracy of the method of purposive selection of non-linearity of regression of the character sought on the control.

We shall consider the result of sampling from four populations, in one of which the weighted regression of \bar{x} on y is linear, and in three others where it is showing different degrees of deviation from linearity. All four populations are divided into three strata according to the values of the control $y = -1$, $y = 0$ and $y = +1$. Each stratum contains three districts. The construction of the population, say π_1 with linear weighted regression is shown in Table II.

TABLE II.

$y = -1.$			$y = 0.$			$y = +1.$		
No. of District \dagger .	u_i .	v_i .	No. of District \dagger .	u_i .	v_i .	No. of District \dagger .	u_i .	v_i .
1	-17	1	4	1	3	7	20	3
2	-18	2	5	0	2	8	18	2
3	-19	3	6	-1	1	9	16	1
Totals	-54	6	—	0	6	—	54	6
Means	$\bar{x}(-1) = -9$	—	—	$\bar{x}(0) = 0$	—	—	$\bar{x}(1) = 9$	—

As in the actual calculations we have to use the products $\bar{x}_i v_i = u_i$, I have omitted the values of the \bar{x} 's and have given the values of the u 's instead. It is easy to see that the population values $X_1 = Y = 0$. The weighted averages of the \bar{x} 's in each array are given at the bottom, namely -9 , 0 , $+9$, and it is seen that the regression is linear.

The populations π_2 , π_3 and π_4 may be obtained from the population π_1 so easily that it is not necessary to describe them in special tables. The population π_2 is obtained by keeping the strata corresponding to $y = -1$ and $y = +1$ unchanged and by adding to each value of u_i in the stratum $y = 0$ the same number, 6. As a result of this the weighted mean of \bar{x} , say $\bar{x}(0)$ in the middle stratum will be raised to $\bar{x}(0) = 3$ and the regression will cease to be linear.

X will now have the value $X_2 = 1$. The population π_3 will be obtained from the population π_2 in the same way as this was obtained from the population π_1 . Similarly, the population π_4 will be obtained from π_3 by the same operation. The values of the weighted mean of x 's in the stratum $y = 0$ and in the populations will be as follows :

$$\begin{aligned}\bar{x}_3(0) &= 6, & X_3 &= 2, & . & . & . & . & . & (42) \\ \bar{x}_4(0) &= 9, & X_4 &= 3.\end{aligned}$$

I then considered all possible samples from these populations, subject to the conditions : (a) $\Sigma(v) = 7$, i.e. the number of individuals in the sample (not the number of elements of the sample) is fixed in advance, and (b) the sample weighted mean of the control y should be equal to its population value $Y = 0$. The details of the results obtained are given in the following Table III :

TABLE III.

Populations.	π_1 .	π_2 .	π_3 .	π_4 .	All popul.
Districts.	$\Delta' = \bar{X}'$.	Δ' .	Δ' .	Δ' .	Δ'' .
1, 2, 6, 7	-2.29	-2.43	-2.57	-2.71	.25
1, 2, 6, 8, 9	- .29	- .43	- .57	- .71	-.25
3, 6, 7	.00	- .14	- .29	- .43	.00
3, 6, 8, 9	2.00	1.86	1.71	1.57	-.50
2, 4, 8	.14	.00	- .14	- .28	.17
2, 5, 6, 8	- .14	.57	1.29	2.00	-.08
1, 4, 5, 9	.00	.71	1.43	2.14	-.08

Here X' and X'' mean the estimates of X , (i) obtained by method proposed by Gini and Galvani, and (ii) calculated from the formula (35). $\Delta' = X' - X$ and $\Delta'' = X'' - X$ represent the errors of these estimates. It will be seen that the estimate X'' gives generally better results. But this is not an essential point in the example, as it is easy to construct another in which the estimate X' would be the better. In fact, the accuracy of X'' is connected with the variability of the u 's within the strata. If in single strata corresponding to different values of y , the variation of the u 's is very large, then the results obtained by using X'' would not be very good. The comparison between two methods could perhaps be worked out arithmetically if we were to consider second order strata. But this would extend the example to the point of losing its illustrative properties.

What is important to note is that the results obtained by using X' get worse and worse with the departure from the linearity of regression. This last circumstance does not affect the accuracy of X'' at all. On the other hand, a change in the values of σ_y would affect X'' .

V. CONCLUSIONS.

Let us now turn to the question, which I raised at the beginning of the paper, whether the idea of a certain equivalency of the two aspects of the representative method is really justified. We shall have to consider both the theory and the practical results obtained by both methods. Professor Bowley, who was first to give the theory of the method of purposive selection, has not, I believe, used it in practice. The most important research, known to me, by which the representative method was used, is the *New Survey of London Life and Labour*. It has been directed by Bowley, who chose the method of random sampling by groups. This is, I think, an example of the intuition to which Laplace referred.

The Italian statisticians, who applied the method of purposive selection of very few (29) and very large districts with populations from about 30,000 to about 1 million persons, did not find their results to be satisfactory. The comparison between the sample and the whole country showed, in fact, that though the average values of seven controls used are in a satisfactory agreement, the agreement of average values of other characters, which were not used as controls, is often poor. The agreement of other statistics besides the means, such as the frequency distributions, etc., is still worse. This applies also to the characters used as controls. The statement of the above facts is followed in the paper by Gini and Galvani by general considerations concerning the concept of a representative sample. They question whether it is possible to give any precise sense to the words "a generally representative sample." I think it is, and I agree also that an exhaustive enquiry is the only method which can give absolutely true results. However, the need for a representative method is an urgent one and many enquiries would be impossible if we were not able to use this method. In fact we are often forced to apply sampling for general purposes, so as to get a "generally representative" sample, which might be used for a variety of different purposes.

If there are difficulties in defining the "generally representative sample," I think it is possible to define what should be termed a *representative method of sampling* and a *consistent method of estimation*. These I think may be defined accurately as follows. I should use these words with regard to the method of sampling and to the method of estimation, if they make possible an estimate of the accuracy of the results obtained in the sense of the new form of the problem of estimation, *irrespective of the unknown properties of the population* studied. Thus, if we are interested in a collective character X of a population π and use methods of sampling and of estimation, allowing

us to ascribe to every possible sample, Σ , a confidence interval $X_1(\Sigma)$, $X_2(\Sigma)$ such that the frequency of errors in the statements

$$X_1(\Sigma) \leq X \leq X_2(\Sigma) \quad . \quad . \quad . \quad . \quad (43)$$

does not exceed the limit $1 - \varepsilon$ prescribed in advance, *whatever the unknown properties of the population*, I should call the method of sampling representative and the method of estimation consistent. We have seen that the method of random sampling allows a consistent estimate of the average X whatever the properties of the population. Choosing properly the elements of sampling we may deal with large samples, for which the frequency distribution of the best linear estimates is practically normal, and there are no difficulties in calculating the confidence intervals. Thus the method of random stratified sampling may be called a representative method in the sense of the word I am using. This, of course, does not mean that we shall always get correct results when using this method. On the contrary, erroneous judgments of the form (43) must happen, but it is known how often they will happen in the long run: their probability is equal to ε .

On the other hand, the consistency of the estimate suggested by Gini and Galvani, based upon a purposely selected sample, depends upon hypotheses which it is impossible to test except by an extensive enquiry.

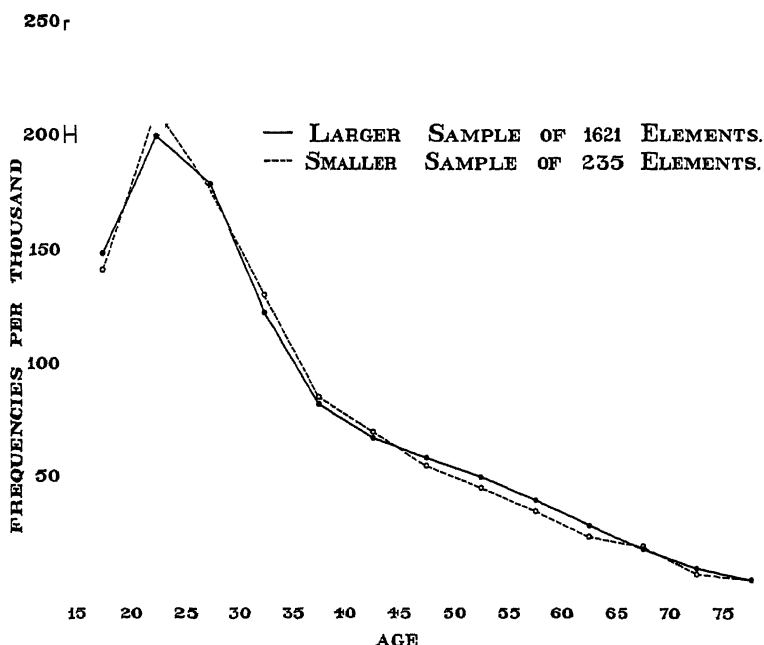
If these hypotheses are not satisfied, which I think is a rather general case, we are not able to appreciate the accuracy of the results obtained. Thus this is not what I should call a representative method. Of course it may give sometimes perfect results, but these will be due rather to the uncontrollable intuition of the investigator and good luck than to the method itself. Even if the underlying hypotheses are satisfied, we have to remember that the elements of sampling which it is possible to use when applying the purposive selective method, must be very few in number and very large in size. Consequently I think that when using this method we are very much in the position of a gambler, betting at one time £100.

For the above reasons I have advised the Polish Institute for Social Problems to use the method of random stratified sampling by groups when carrying out the enquiry on the structure of Polish workers.*

Poland was divided into 113 strata, containing 123,383 elements of sampling (statistical districts). The average number of persons within an element of sampling was about 250 persons. There were

* The results of this enquiry are to be found in the publication of J. Piekałkiewicz: *Rapport sur les recherches concernant la structure de la population ouvrière en Pologne selon la méthode représentative*. Institute for Social Problems, Warsaw, 1934.

considerable variations from stratum to stratum. The random stratified sample contained altogether 1,621 elements, thus about 1.24 per cent. of the whole population. I am not yet able to state how accurate are the results obtained, as the respective data of the General Census are not yet published. All that was possible in testing their accuracy was to compare the age distribution of workers found in the whole sample with the age distribution computed from a minor sample of 235 elements selected for an introductory enquiry

FIG III.

which aimed at testing the variability within the strata. The results are presented in Figure III and in Table IV, and seem to be satisfactory. However, even if through the chances of sampling they had been bad, I think I was justified in advising the method of stratified sampling by groups, because I was able to calculate that (with the probability of an error equal to .01) the error of actuarial calculations, based upon the tables which were computed as the result of enquiry, could not exceed 4.5 per cent.

The method of stratified sampling by groups has been recently used by Professor O. Anderson,* who directed an enquiry into the farm-

* *Bull. de Statistique*, publ. Direction Gen. de Statistique de Bulgarie, No. 8, 1934.

ing conditions in Bulgaria. The process of getting the sample with which he was faced was a more difficult one, as this was not a sample of sheets of paper containing the necessary information, but a sample of villages from which it was necessary to collect the original data. In fact the enquiry in question was a substitute for a general agricultural census. The element of the sampling was a village. The total number of about 5,000 villages was divided into 28 strata. Out of each stratum 2 per cent. of the villages were selected to form the sample. There is only one detail in this enquiry which I am not certain is justifiable. When selecting the villages from single strata special attention was paid to selecting villages which according to the last General Census in 1926 showed a dis-

TABLE IV.
Age Distribution of Polish Workers.
Males.

Age.	Larger Sample.	Smaller Sample.
15-19	148	141
20-24	109	213
25-29	178	176
30-34	122	130
35-39	82	85
40-44	67	69
45-49	58	54
50-54	49	44
55-59	39	34
60-64	28	23
65-69	18	19
70-74	9	7
75-79	4	4
Totals	1001	999

tribution of different characters of farms, similar to that in the whole stratum. I think that the variability of farms and villages is also a character of their population which may be of interest. This character, however, if the efforts of Bulgarian investigators were successful, would be biased in the sample.

The final conclusion which both the theoretical considerations and the above examples suggest is that the only method which can be advised for general use is the method of stratified random sampling. If the conditions of the practical work allow, then the elements of the sampling should be individuals. Otherwise we may sample groups, which, however, should be as small as possible. The examples of enquiries in London, in Bulgaria, and in Poland show that random sampling by groups does not present unsurmountable difficulties.

There are instances when we may select individuals purposely with great success. Such is, for instance, the case when we are interested in regression of some variate y on x , in which case the selection of individuals with values of x varying within broad limits would give us more precision. But these cases are rather exceptional.*

VI. APPENDIX.

Note I.

Suppose we are taking samples, Σ , from some population π . We are interested in a certain collective character of this population, say θ . Denote by x a collective character of the sample Σ and suppose that we have been able to deduce its frequency distribution, say $p(x|\theta)$, in repeated samples and that this is dependent on the unknown collective character, θ , of the population π .

The collective characters I am speaking about are arbitrary. The position may be illustrated, for instance, by supposing that the collective character θ is the proportion of a certain type of individuals in the population π , and x the proportion of the same type of individuals in the sample. The distribution of x is then a binomial, depending upon the value of θ .

Denote now by $\varphi(\theta)$ the unknown probability distribution *a priori* of θ . Suppose that the general conditions of sampling and the properties of the collective characters θ and x define certain values which these characters may possess. In the example I mentioned above, θ , the proportion of individuals of the given type in the population may be any number between 0 and 1. On the other hand, x , the proportion of these individuals in the sample, say of n , could have values of the form k/n , k being an integer $0 \leq k \leq n$.

The new form of the problem of estimation of the collective character θ may be stated as follows: given any positive number $\epsilon < 1$, to associate with any possible value of x an interval

$$\theta_1(x) < \theta_2(x) \quad . \quad . \quad . \quad . \quad . \quad (1)$$

such that if we accept the rule of stating that the unknown value of the collective character θ is contained within the limits

$$\theta_1(x') \leq \theta \leq \theta_2(x') \quad . \quad . \quad . \quad . \quad . \quad (2)$$

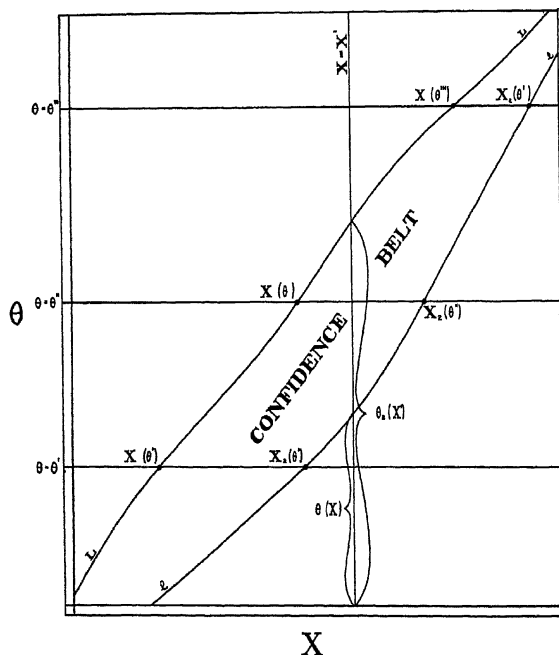
every time the actual sampling provides us with the value $x = x'$, the probability of our being wrong is less than or at most equal to $1 - \epsilon$, and this whatever the probability law *a priori*, $\varphi(\theta)$.

The value of ϵ , chosen in a quite arbitrary manner, I propose

* Interesting remarks in this respect are to be found in the excellent book of M. Ezekiel: *Methods of Correlation Analysis* (1930).

to call the "confidence coefficient." If we choose, for instance, $\varepsilon = .99$ and find for every possible x the intervals $[\theta_1(x), \theta_2(x)]$ having the properties defined, we could roughly describe the position by saying that we have 99 per cent. confidence in the fact that θ is contained between $\theta_1(x)$ and $\theta_2(x)$. The numbers $\theta_1(x)$ and $\theta_2(x)$ are what R. A. Fisher calls the fiducial limits of θ . Since the word "fiducial" has been associated with the concept of "fiducial pro-

FIG. IV



bability" which has caused the misunderstandings I have already referred to, and which in reality cannot be distinguished from the ordinary concept of probability, I prefer to avoid the term and call the intervals $[\theta_1(x), \theta_2(x)]$ the confidence intervals, corresponding to the confidence coefficient ε . The solution of the problem thus stated is an immediate one.

Consider the plane on which the rectangular axes of coordinates OX and $O\theta$ are drawn. Fix any possible value of θ , say $\theta = \theta'$, and find on the straight line

$$\theta = \theta' \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (3)$$

an interval, say $x_1(\theta')$ to $x_2(\theta')$, having the property that in cases when θ' is the true value of the collective character θ , the probability, say $P(\theta')$, of having from the sample x within the limits

$$x_1(\theta') \leq x \leq x_2(\theta') \quad . \quad . \quad . \quad . \quad (4)$$

is larger than or at least equal to ε . Obviously the limits $x_1(\theta')$ and $x_2(\theta')$ may be always found, and this generally in many different ways. If the variate x is a continuous one, then the limits $x_1(\theta')$ and $x_2(\theta')$ may be fixed so as to have rigorously

$$P(\theta') = \varepsilon \quad . \quad . \quad . \quad . \quad . \quad (5)$$

In the case, however, when the variate x is not continuous, for instance if it follows the binomial law of frequency, we should have only

$$P(\theta) > \varepsilon \quad . \quad . \quad . \quad . \quad . \quad (6)$$

For the sake of definiteness, we shall assume that the interval $[x_1(\theta'), x_2(\theta')]$ is chosen to be the shortest possible satisfying the condition (6). Such an interval will be called the interval of acceptance, corresponding to the chosen value of ε . Suppose now we have found the intervals of acceptance, corresponding to all possible values of θ . Now join all left-hand side boundaries of the intervals of acceptance by a continuous line, which may be a smooth curve or a polygon. Denote this line by LL . Another line, say ll , will join the right-hand side boundaries of the intervals of acceptance. The two lines LL and ll will be boundaries of a certain belt, which I shall call the confidence belt, CB .

Consider now the points, say A with coordinates $(x_1\theta)$, thus representing combinations of all possible values of x and θ . The confidence belt CB as defined above has the fundamental property that whatever the probability law *a priori* $\varphi(\theta)$, the probability of having the point A inside of the confidence belt is equal to or larger than the chosen value of the confidence coefficient ε . This probability may be represented either by means of integrals or by means of the sums extending over all possible positions of the point A inside CB , according to the properties of the variates x and θ , which may be continuous or not. Thus if p_{CB} is the probability under consideration, we should have either the expression

$$p_{CB} = \int \int_{CB} \varphi(\theta) p(x|\theta) dx d\theta, \quad . \quad . \quad . \quad (7)$$

or

$$p_{CB} = \sum_{\theta} \varphi(\theta) \sum_{\substack{x \leq X_1(\theta) \\ x_1(\theta) \leq x}} p(x|\theta), \quad . \quad . \quad . \quad (8)$$

or

$$p_{CB} = \sum_{\theta} \varphi(\theta) \int_{x_1(\theta)}^{x_2(\theta)} p(x|\theta) dx, \quad . \quad . \quad . \quad . \quad (9)$$

or finally

$$p_{CB} = \int \varphi(\theta) \sum_{x_1(\theta)}^{x_2(\theta)} p(x|\theta) d\theta, \quad . \quad . \quad . \quad . \quad (10)$$

all summations and integrations extending over the area of CB . It will be noticed that the case of θ and x being proportions of certain individuals in the population and in the sample could lead us either to the formula (8) or to the formula (10) according to the assumptions about the population sampled, which may be finite or infinite.

Whatever the case may be and whichever of the four formulæ may accurately correspond to the actual conditions of the problem, the summations and the integrations may be executed in the same order. We sum first (or integrate) for different values of x , that is for the values contained in the interval of acceptance, corresponding to a fixed value of θ . This gives us the probability $P(\theta)$, which owing to the special choice of the interval of acceptance is $\geq \varepsilon$. Substituting ε in the formula giving p_{CB} for the integral or sum with regard to x , we get either

$$p_{CB} = \int \varphi(\theta) P(\theta) d\theta \geq \varepsilon \int \varphi(\theta) d\theta = \varepsilon. \quad . \quad . \quad (11)$$

or

$$p_{CB} = \sum_{\theta} \varphi(\theta) P(\theta) \geq \varepsilon \sum_{\theta} \varphi(\theta) = \varepsilon. \quad . \quad . \quad . \quad (12)$$

where the integration or summation with regard to θ extends over all possible value of this character. Thus the respective integral or sum of $\varphi(\theta)$ is equal to one. The above formulæ complete the proof of the fundamental property of the confidence belt. It is to be noted that if x is continuous and the intervals of acceptance are so chosen that $P(\theta) = \varepsilon$ for every θ , then, whatever the unknown distribution *a priori* of θ , we should have

$$p_{CB} = \varepsilon. \quad . \quad . \quad . \quad . \quad (13)$$

The construction of the confidence belt is quite independent of any arbitrary assumption concerning the values of θ . If the confidence belt is constructed, we may affirm that the point A will lie inside of the belt. This statement may be erroneous, but the probability of the error is either equal to or less than $1 - \varepsilon$ —thus is as small as desired.

The solution of the problem of estimation consists in constructing the confidence belt and in affirming that the point A , representing the combination of some possible value of x with some possible value of θ , will lie inside of the belt. When observation provides

us with the value of $x = x'$, we shall consider this as additional, and this time accurate, information about the position of the point A , and shall combine it with the previous (uncertain) statement that A lies inside CB . We shall draw the line parallel to the axis of θ and corresponding to the equation

$$x = x' \quad . \quad . \quad . \quad . \quad . \quad . \quad (14)$$

and find its intersections with the boundaries ll and LL of the confidence belt. Denote by $\theta_1(x')$ and $\theta_2(x')$ the ordinates of these points of intersections. The interval $\theta_1(x')$, $\theta_2(x')$ will be the confidence interval corresponding to $x = x'$. Stating that

$$\theta_1(x') \leq \theta \leq \theta_2(x') \quad . \quad . \quad . \quad . \quad . \quad (15)$$

every time the observation gives us $x = x'$ we may be wrong. This will happen only if the point A happens to be outside the confidence belt, but the probability of this last fact is equal to $1 - \epsilon$.*

Note II. The Markoff Method and Markoff Theorem on Least Squares.

The importance of the work of Markoff concerning the best linear estimates consists, I think, chiefly in a clear statement of the problem. The subsequent theory is a matter of easy algebra.

Suppose we have a sample of n values

$$x_1, x_2, \dots, x_n \quad . \quad . \quad . \quad . \quad . \quad . \quad (1)$$

each being randomly drawn from some population $\pi_i (i = 1, 2, \dots, n)$. Denote by A_i and σ_i the mean and the standard deviation in the population π_i . Suppose further that it is known that

$$A_i = a_{i1}p_1 + a_{i2}p_2 + \dots + a_{is}p_s \quad . \quad . \quad . \quad (2)$$

where the p 's are some unknown parameters, and the a 's known coefficients and where $s \leq n$. Consider now the problem of finding

* The theory developed by Fisher runs on somewhat different lines. It applies only to the case just described when we know the distribution of the collective character x depending upon only one unknown character. The method I am using seems to have the advantage that it allows an easy generalization to the case where there are many unknown parameters in the frequency distribution of several variates describing the results of sampling, while we are interested only in the value of some of them. My method of approach seems to have also the advantage that starting with the calculations depending explicitly upon the unknown probability law *a priori* it shows exactly how this dependence is being eliminated. This theory has been partly set out in my lectures at the University of Warsaw and is now the chief topic of my lectures delivered at University College. It is hoped it will be soon published as an issue of a lecture series delivered at the Department of Applied Statistics at University College, London. The case when θ and x are proportions of some individuals in the population and in the sample is discussed in the paper by C. J. Cloper and E. S. Pearson (now in print) giving some interesting remarks on the relationship between the concepts of confidence intervals and the probabilities *a posteriori* in the sense of Bayes. This paper contains also graphs with a system of confidence belts, corresponding to different sizes of the samples and to different confidence coefficients.

the best linear estimate of a collective character of the populations defined by the equation

$$\theta = b_1 p_1 + b_2 p_2 + \dots + b_s p_s \quad (3)$$

the b 's being known coefficients.

The method of the solution follows at once from the statement of the problem. It will be convenient to use the notation $E(x)$ for the mean value of any variate x . Denote by θ' a linear function of x 's :

$$\theta' = \Sigma(\lambda_i x_i) \quad (4)$$

Our problem consists in determining the λ 's so that both

$$E(\theta') = \theta \quad (5)$$

and

$$\sigma_{\theta'}^2 = E(\theta' - \theta)^2 = \text{minimum} \quad (6)$$

The condition (5) leads to the following equations which we reach by taking into account (2) and (3) :

$$E(\theta') = \Sigma \lambda_i E(x_i) = \theta \quad (7)$$

or

$$\begin{aligned} p_1 \Sigma(\lambda_i a_{i1}) + p_2 \Sigma(\lambda_i a_{i2}) + \dots + p_s \Sigma(\lambda_i a_{is}) = \\ p_1 b_1 + p_2 b_2 + \dots + p_s b_s \end{aligned} \quad (8)$$

This equality should hold whatever be the unknown parameters p_1, p_2, \dots, p_s .

This is possible only if we have

$$\begin{aligned} \Sigma(\lambda_i a_{i1}) &= b_1 \\ \Sigma(\lambda_i a_{i2}) &= b_2 \\ &\vdots \\ \Sigma(\lambda_i a_{is}) &= b_s \end{aligned} \quad (9)$$

As there are s linear equations with regard to $n \geq s$ unknown coefficients λ we may generally make a choice among all possible systems satisfying (9) in order to satisfy (6).

Using the known formula for the variance of a linear function of n variables x_i , we may write the condition (6) in the form

$$\sigma_{\theta'}^2 = \Sigma(\lambda_i^2 \sigma_i^2) + 2 \Sigma \Sigma (\lambda_i \lambda_j \sigma_i \sigma_j r_{ij}) \quad (10)$$

The values of λ satisfying (9) and minimising (10) may be easily found provided we have sufficient information concerning the σ_i 's and the correlation coefficients r_{ij} . The case considered by Markoff is when it is known that $r_{ij} = 0$, and

$$\sigma_i^2 = \frac{\sigma^2}{P_i} \quad (11)$$

P_i being a known number and σ^2 some unknown constant. In this case the function (10) to minimize may be written in the form

$$\sigma_{\theta'}^2 = \sigma^2 \Sigma \left(\frac{\lambda_i^2}{P_i} \right) \quad (12)$$

The solution of minimizing (12), or, which is the same, of minimizing the sum

$$\sum \left(\frac{\lambda_i^2}{P_i} \right) \cdot \cdot \cdot \cdot \cdot \cdot \quad (13)$$

under the condition of having (9) satisfied, is now a straight forward one. It requires, however, that among n equations (2) connecting the means A_i with the parameters p there should be at least s independent equations. If this condition is satisfied, then the solution of the whole problem is given by the following theorem of Markoff.*

The best linear estimate of θ is obtained by substituting in (3) instead of parameters p , linear functions of the x 's say

$$q_1^o, q_2^o, \cdot \cdot \cdot q_s^o \cdot \cdot \cdot \cdot \cdot \quad (14)$$

found by minimizing the sum of squares

$$S = \sum (x_i - a_{i1}q_1 - a_{i2}q_2 - \cdot \cdot \cdot - a_{is}q_s)^2 P_i \quad (15)$$

with regard to the q 's considered as independent variables.

The second part of this very important theorem gives us an estimate of the variance of θ' . Denote by μ^2 the estimate of $\sigma^2_{\theta'}$, and by S_0 the minimum value of S obtained from (15) by substituting the functions (14) for the q 's. Then, according to the result of Markoff

$$\mu^2 = \frac{S_0}{n-s} \sum \left(\frac{\lambda_i^2}{P_i} \right) \cdot \cdot \cdot \cdot \cdot \quad (16)$$

If it were known that $P_1 = P_2 = \cdot \cdot \cdot = 1$, then the ratio $S_0/(n-s)$ would be the estimate of the value of the variance σ^2 , common to all x 's. Considering the denominator in (16) we recognize in $n-s$ the number of degrees of freedom—the concept introduced by R. A. Fisher—equal to the number of observations, n , minus the number of independent parameters.

The above results concern the case when the variables (1) are independent. If their dependency arises from the fact that they are characters of individuals randomly drawn from limited populations, then the above results may be easily adapted to this case. In particular the method of Markoff applies when we are dealing with stratified sampling.

Consider, for example, the problem of estimating the sum $\theta = \sum \Sigma(u)$ of some numbers u associated with the elements of some stratified population π . Denote by π_i the i -th stratum ($i = 1, 2, \cdot \cdot \cdot k$), by M_i —the number of its elements, by \bar{u}_i the mean of

* Actually Markoff formulated his theorem in a slightly different form, but this difference is of no importance, and the form here chosen seems to be more convenient.

the u 's corresponding to the elements of π_i and by σ_i their standard deviation. The letters u_{ij} , x_{ij} , and m_i will denote respectively the value of u corresponding to the j -th element of π_i , the value of u corresponding to the j -th of the elements selected from π_i to form the sample and the number of the elements of π_i selected for the sample. We may write now

$$\theta = \Sigma(M_i \bar{u}_i) \quad . \quad . \quad . \quad . \quad . \quad (17)$$

To find the best linear estimate of θ we write

$$\theta' = \sum_{i=1}^k \sum_{j=1}^{m_i} (\lambda_{ij} x_{ij}) \quad . \quad . \quad . \quad . \quad . \quad (18)$$

and then try to find such values of the coefficients λ which would satisfy the conditions

$$E(\theta') = \theta \quad . \quad . \quad . \quad . \quad . \quad (19)$$

whatever is the value of θ and of the \bar{u} 's and

$$E(\theta' - \theta)^2 = \text{minimum} \quad . \quad . \quad . \quad . \quad . \quad (20)$$

Owing to (17) and to the obvious fact that

$$E(x_{ij}) = \bar{u}_i \quad . \quad . \quad . \quad . \quad . \quad (21)$$

the condition (19) transforms itself into the following :

$$\sum_{i=1}^k \left(\bar{u}_i \left(\sum_{j=1}^{m_i} \lambda_{ij} - M_i \right) \right) = 0. \quad . \quad . \quad . \quad . \quad (22)$$

This shows that the necessary and sufficient conditions which the λ 's must satisfy in order to have (19) satisfied whatever the unknown properties of the population, will be the following :

$$\sum_{j=1}^{m_i} (\lambda_{ij}) = M_i \quad (i = 1, 2, \dots, k) \quad . \quad . \quad . \quad (23)$$

This being fixed, consider the condition (20).

Straightforward algebra gives for the left-hand side of (20) the expression, say,

$$\sigma^2_{\theta'} = \sum_{i=1}^k \left\{ \sigma_i^2 \left(m_i \frac{M_i - m_i \lambda_i}{M_i - 1} + \frac{M_i}{M_i - 1} \sum_{j=1}^{m_i} (\lambda_{ij} - \lambda_i)^2 \right) \right\}, \quad . \quad (24)$$

where λ_i stands for the mean value of λ_{ij} calculated from (23), that is,

$$\lambda_i = \frac{M_i}{m_i}. \quad . \quad . \quad . \quad . \quad . \quad (25)$$

We see now $\sigma_{\theta'}^2$ is minimized by a system of λ 's satisfying (23) in which, where $j = 1, 2, \dots, m_i$

$$\lambda_{ij} = \lambda_i = \frac{M_i}{m_i} \quad . \quad . \quad . \quad . \quad . \quad . \quad (26)$$

It will be noticed that this result holds good not only whatever be the unknown \bar{u}_i , but also whatever the standard deviations σ_i . Thus if we denote by \bar{x}_i the mean value x_{ij} for any stratum, then the function

$$\theta' = \sum_{i=1}^k (M_i \bar{x}_i) \quad . \quad . \quad . \quad . \quad . \quad . \quad (27)$$

is the best linear estimate of 0 whatever the properties of the population. The familiar formula for the variance of θ' is easily obtained from (24) and (25) :

$$\sigma_{\theta'}^2 = \sum_{i=1}^k M_i \frac{M_i - m_i}{m_i} \frac{M_i \sigma_i^2}{M_i - 1} \quad . \quad . \quad . \quad (28)$$

The estimate θ' is, of course, the one which could be suggested on purely intuitive grounds. The advantage of using Markoff's method consists (i) in avoiding biased estimates, which may be sometimes used when their choice is based on intuition only, and (ii) in finding the best linear estimates. It would be rather difficult to fulfil this last condition on intuitive grounds only.

Note III. The consistency and the efficiency of the estimate of C. Gini and L. Galvani.

Consider a population π of districts divided into second order strata, π_{y_i} , according to the values of the control y and the number v of individuals in the districts. Thus any district in the stratum π_{y_i} contains the same number of individuals v and the value of the control corresponding to each district is also the same y . Denote by M_{y_i} and m_{y_i} the total number of districts contained in π_{y_i} and the number of them to be included in the sample. The letters $u_{y_i i}$ and $x_{y_i i}$ will denote the values of the character sought, x , associated respectively with the i -th district of the stratum π_{y_i} and with the i -th district out of the m_{y_i} of them, which have been selected from this stratum. The letters u_{y_i} and x_{y_i} will denote the means of $u_{y_i i}$ and $x_{y_i i}$ corresponding to the stratum π_{y_i} and to the partial sample of districts, drawn from this stratum. The standard deviation of $u_{y_i i}$ will be denoted by σ_{y_i} . Finally, X and Y will denote the weighted means of the character sought x and of the control, calculated for the whole population π . The sample weighted means will be denoted by X_s and Y_s . Denote further by

$$W = \sum_{y_i} (M_{y_i} v) \quad . \quad . \quad . \quad . \quad . \quad . \quad (1)$$

We shall have

$$X = \frac{1}{W} \sum_y \sum_v (M_{yv} v u_{yv}), \quad . \quad . \quad . \quad . \quad (2)$$

$$Y = \frac{1}{W} \sum_y \sum_v (M_{yv} v y), \quad . \quad . \quad . \quad . \quad (3)$$

$$X_{\Sigma} = \frac{\sum_y \sum_v (m_{yv} v x_{yv})}{\sum_y \sum_v (m_{yv} v)}, \quad . \quad . \quad . \quad . \quad (4)$$

$$Y_{\Sigma} = \frac{\sum_y \sum_v (m_{yv} v y)}{\sum_y \sum_v (m_{yv} v)}. \quad . \quad . \quad . \quad . \quad (5)$$

Using this notation, we shall now consider the necessary condition which must be satisfied by x and y in the case when the estimate of Gini and Galvani is consistent. This condition is more easily found when we consider the ideal case where the sample weighted mean Y_{Σ} is exactly equal to its population value Y . In this case the estimate of Gini and Galvani reduces itself to X_{Σ} . Thus we shall consider the conditions under which the mean of X_{Σ} in repeated samples is equal to X whenever

$$Y_{\Sigma} = Y. \quad . \quad . \quad . \quad . \quad (6)$$

We suppose that the numbers m_{yv} are fixed in some way or other in order to satisfy (6), and consider the mean value of X_{Σ} , which we should get from all possible samples, corresponding to the fixed values of m_{yv} . We shall have

$$E(X_{\Sigma}) = \frac{\sum_y \sum_v (m_{yv} v u_{yv})}{\sum_y \sum_v (m_{yv} v)} = \bar{X}_{\Sigma} \text{ (say)}. \quad . \quad . \quad . \quad (7)$$

Now we wish to have

$$\bar{X}_{\Sigma} = X, \quad . \quad . \quad . \quad . \quad (8)$$

whenever (6) is satisfied.

The equations (6) and (8) may be written in the following form

$$\sum_y \sum_v m_{yv} v (y - Y) = 0, \quad . \quad . \quad . \quad . \quad (9)$$

$$\sum_y \sum_v m_{yv} v (u_{yv} - X) = 0, \quad . \quad . \quad . \quad . \quad (10)$$

and it is easily seen that if it is required that (10) holds good whenever the numbers m_{yv} satisfy (9), it is necessary that

$$u_{yv} - X = A(y - Y), \quad . \quad . \quad . \quad . \quad (11)$$

A being an absolute constant, independent of y and v .

The necessary (and obviously also sufficient) condition (11) of the consistency of the estimate of Gini and Galvani is a rather peculiar one. It is to be noticed that it is more limiting than the

hypothesis H mentioned in the text (p. 571). In fact (11) means that the regression of x on y should be linear not only if we consider the whole population of districts, but also if we consider the part of this population containing only districts with a fixed number of individuals v . Furthermore, the regression lines corresponding to different v 's should be the same. Denote the hypothesis that these conditions are fulfilled by H' . Obviously if H' is true, then H is also true, but not inversely.

It is perhaps worth noticing that X_{Σ} may be a consistent estimate of X for a special system of the m 's. In fact denote

$$\sum_y \sum_v (m_{yv}v) = w \quad . \quad . \quad . \quad . \quad . \quad (12)$$

and subtract (2) from (7) :

$$\bar{X}_{\Sigma} - X = \sum_y \sum_v \left\{ v u_{yv} \left(\frac{m_{yv}}{v} - \frac{M_{yv}}{W} \right) \right\} \quad . \quad . \quad . \quad (13)$$

It is easily seen that if for any y and v

$$\frac{m_{yv}}{M_{yv}} = \frac{w}{W} = \text{const.}, \quad . \quad . \quad . \quad . \quad . \quad (14)$$

then (13) vanishes and X_{Σ} becomes an unbiased estimate of X whatever the properties of the population. However, it may be noticed that the fulfilment of (14) means the rejection of the principle of purposive selection.

Assume now that the hypothesis H' is true and find the best linear estimate of X corresponding to any system of m 's not necessarily satisfying the condition (6). As the values $x_{y_{11}}, x_{y_{12}}$ corresponding to two districts drawn from the same stratum π_{yv} are correlated, it is impossible to apply the theorem of Markoff at once. We shall do so later on. However, we must start by following the general method. Denoting by θ' the linear function of x 's required, we shall have

$$\theta' = \sum_y \sum_v \sum_i (\lambda_{y_{1i}} x_{y_{1i}}) \quad . \quad . \quad . \quad . \quad . \quad (15)$$

It must satisfy the conditions

$$E(\theta') = X \quad . \quad . \quad . \quad . \quad . \quad (16)$$

and if $\sigma^2_{\theta'}$ stands for the variance of θ' ,

$$\sigma^2_{\theta'} = \text{minimum.} \quad . \quad . \quad . \quad . \quad . \quad (17)$$

Since the values of the control are known for all districts, we may change the origin of co-ordinates and assume that $Y = 0$.

According to the assumed hypothesis, H' , (see (11)) we have then

$$E(x_{y_{1i}}) = u_{yv} = X + Ay \quad . \quad . \quad . \quad . \quad . \quad (18)$$

where X and A play the rôle of the unknown parameters, p , considered in the theory of the Markoff method. Therefore

$$E(\theta') = \sum_y \sum_v \sum_i (\lambda_{yvi}(X + Ay)) = \\ X \sum_y \sum_v \sum_i (\lambda_{yvi}) + A \sum_y \{y \sum_v \sum_i (\lambda_{yvi})\} \quad (19)$$

The values of the λ 's must be so chosen that this last expression should be identically equal to X whatever the unknown value of A . Thus we should have, say

$$f = \sum_y \sum_v \sum_i (\lambda_{yvi}) = 1 \quad (20)$$

$$\phi = \sum_y \{y \sum_v \sum_i (\lambda_{yvi})\} = 0 \quad (21)$$

These are the conditions of the consistency of the estimate θ' . Now consider the condition of its being a best linear estimate. Taking into account the correlation between x_{yvi} and x_{yvj} , the variance of θ' may be written in the form, which is easy to check

$$\sigma^2_{\theta'} = \sum_y \sum_v \left\{ \sigma^2_{yvi} \left(\sum_i (\lambda_{yvi}^2) - \frac{2}{M_{yv} - 1} \sum_i (\lambda_{yvi} \lambda_{yvi}) \right) \right\} \quad (22)$$

We proceed to minimize this expression with regard to all systems of the λ 's satisfying (20) and (21). For this purpose we shall equate to zero the derivatives of the function, say,

$$F = \sigma^2_{\theta'} - 2\alpha f - 2\beta \phi, \quad (23)$$

α and β being some coefficients to be determined from (20) and (21). We have

$$\frac{\partial F}{\partial \lambda_{yvi}} = 2\sigma^2_{yvi} \left\{ \lambda_{yvi} - \frac{1}{M_{yv} - 1} \left(\sum_{j=1}^{m_{yv}} (\lambda_{yvj}) - \lambda_{yvi} \right) - \alpha - \beta y \right\} = 0 \quad (24)$$

The above equation may be written in the following form

$$M_{yv} \lambda_{yvi} = \sum_{j=1}^{m_{yv}} (\lambda_{yvj}) + (\alpha + \beta y)(M_{yv} - 1), \quad (25)$$

which shows that whatever $i = 1, 2, \dots, m_{yv}$, the control y and v being fixed, λ_{yvi} has a constant value, say λ_{yv} . This value may be obtained from (25), in terms of α and β

$$\lambda_{yvi} = \lambda_{yv} = (\alpha + \beta y) \frac{M_{yv} - 1}{M_{yv} - m_{yv}} \quad (26)$$

Substituting this value into (20) and (21) we should be able to calculate α and β and then to find λ_{yv} from (26). However, it is easier to get the result by using the Markoff theorem.

The results which are already obtained justify us in writing

$$\theta' = \frac{\sum_y \sum_v (\lambda_{yv} \sum_i (x_{yi}))}{\sum_y \sum_v (\lambda_{yv} m_{yv} x_{yi})} \quad . \quad . \quad . \quad (27)$$

and thus to treat θ' as a linear function of the variables x_{yi} which, being associated with samplings from different strata, are totally independent. The mean value of x_{yv} is the same as of x_{yi} , equal to u_{yi} . The variance of x_{yi} , say S^2_{yi} , is connected with the variance of x_{yv} and is as follows :

$$S^2_{yv} = \frac{M_{yv} - m_{yv}}{m_{yv}(M_{yv} - 1)} \sigma^2_{yv} = \frac{1}{Q_{yv}} \text{ (say).} \quad . \quad . \quad (28)$$

Thus the original problem of finding a linear function θ' of *dependent* variables x_{yi} satisfying (20) and (21) is now reduced to that of finding a linear function (27) of *independent* variates x_{yv} satisfying the same conditions. This may be done by applying the Markoff theorem. However, we shall have to assume some additional hypotheses concerning the variances σ^2_{yv} . Gini and Galvani assumed in their paper a hypothesis (p. 63) which, I think, in my terminology and notation could be expressed by the equality

$$\sigma^2_{yv} : \sigma^2 = \text{constant.} \quad . \quad . \quad . \quad (29)$$

There is no difficulty in assuming this hypothesis and in finding the best linear estimate of X directly from the Markoff theorem. Comparing (28) and (29) we see that the rôle of the "weights," P , involved in the Markoff theorem is now played by the ratios, say,

$$P_{yv} = \frac{m_{yv}(M_{yv} - 1)}{M_{yv} - m_{yv}} \quad . \quad . \quad . \quad (30)$$

Thus the best linear estimate of X is found by minimizing the sum of squares

$$S = \sum_y \sum_v \left\{ (x_{yv} - q_1 - q_2 y)^2 \frac{m_{yv}(M_{yv} - 1)}{M_{yv} - m_{yv}} \right\} \quad . \quad . \quad (31)$$

with regard to q_1 and q_2 considered as independent variables. The best linear estimate sought, θ' , will be the solution for q_1 , minimizing (31). It is easily seen that it is not the one which has been suggested by Gini and Galvani, which results from minimizing the sum of squares, say

$$S' = \sum_y \sum_v \{ (x_{yv} - q_1 - q_2 y)^2 v m_{yv} \} \quad . \quad . \quad (32)$$

The estimate of Gini and Galvani becomes the best linear estimate when we assume the hypothesis, which will be denoted by H_1 , that the variances S^2_{yv} are inversely proportional to $v m_{yv}$. This could be

true, for instance, if the districts contained in each stratum were samples of v individuals drawn randomly from the population Π . In this case we should have

$$\sigma_{yv}^2 = \frac{\sigma_y^2}{v} \text{ (say).} \quad . \quad . \quad . \quad . \quad . \quad (33)$$

Additional assumptions, that σ_y^2 is independent of y , and is equal to σ^2 , say, and that each $m_{yv} = 1$ will reduce the formula (28) to

$$S_{yv}^2 = \frac{\sigma^2}{v}, \quad . \quad . \quad . \quad . \quad . \quad (34)$$

which will lead to minimizing (32) when getting the best linear estimate of X . I think it would be exceedingly difficult to find instances in social, vital or economic statistics in which the hypothesis H_1 would be true. However, it may be true in some engineering problems.

I want to emphasize that the general problem of estimation of any given collective character θ of a population π must be considered from two different points of view: (i) Given a sample from the population, obtained in some known manner, what arithmetical procedure will give us an unbiased and a most accurate estimate of θ ? (ii) What method of sampling will give samples, allowing the most accurate estimates? These two aspects of the problem may be traced in any theoretical research concerning the representative method. Often the solutions proposed are based only on intuition and require theoretical justification. The principle of the purposive selection method, advising selection of samples such that the weighted sample means of the controls should be equal to their population values, is an intuitive solution of the problem (ii). The methods which have been proposed to estimate the unknown weighted population mean X are the solutions of the problem of kind (i). In the first part of the present *Noté* I have considered the conditions under which the intuitive solutions of the problem (i) are justified. Now I shall proceed to consider whether, and if so then under what conditions, is justified the solution of the problem of kind (ii).

To do so I shall assume that the hypothesis H' is satisfied and shall consider the variance of the best linear estimate, θ' , of the unknown weighted mean X . Its expression will involve the numbers m_{yv} , of districts selected for the sample from each stratum π_{yv} . It will be possible to see what system of these numbers m_{yv} would minimize the value of the variance $\sigma_{\theta'}^2$ of θ' . We shall see that under certain, rather limiting, conditions, the system of m_{yv} minimizing $\sigma_{\theta'}^2$ will be the system for which the sample weighted mean of the control is equal to its population value.

We shall consider the question in its full generality and shall make no assumptions about the variances, $\sigma^2_{y_v}$, of the character sought within the second order strata. This will lead to the expression (28) for the variances of numbers x_{y_v} . The best linear estimate θ' of X will be obtained by minimizing the sum of squares

$$S = \sum_{y,v} \{ (x_{y_v} - q_1 - q_2 y)^2 Q_{y_v} \} \quad . \quad . \quad . \quad (35)$$

with regard to q_1 and q_2 . The solution is easily obtained and is given by the formula

$$\theta' = \sum_{y,v} (\lambda_{y_v} x_{y_v}), \quad . \quad . \quad . \quad . \quad (36)$$

where

$$\lambda_{y_v} = \frac{\sum \Sigma (Q_{y_v} y^2) - y \sum \Sigma (Q_{y_v} y)}{\sum \Sigma (Q_{y_v} y^2) \sum \Sigma (Q_{y_v}) - (\sum \Sigma (Q_{y_v} y))^2} Q_{y_v} \quad . \quad . \quad (37)$$

The variance of (36) is given by the familiar formula

$$\sigma^2_{\theta'} = \sum \Sigma (\lambda_{y_v}^2 S^2_{y_v}). \quad . \quad . \quad . \quad . \quad (38)$$

This, owing to (37) and (28) reduces itself to the following

$$\sigma^2_{\theta'} = \frac{1}{\sum \Sigma (Q_{y_v})} \left\{ 1 + \frac{(\sum \Sigma (Q_{y_v} y))^2}{\sum \Sigma (Q_{y_v} y^2) \sum \Sigma (Q_{y_v}) - (\sum \Sigma (Q_{y_v} y))^2} \right\} \quad . \quad (39)$$

Considering this formula, we see that it will provide a small value of $\sigma^2_{\theta'}$ if we succeed in minimizing say

$$|Y'_z| = \frac{|\sum \Sigma (Q_{y_v} y)|}{\sum \Sigma (Q_{y_v})} \quad . \quad . \quad . \quad . \quad (40)$$

and at the same time maximize $\sum \Sigma (Q_{y_v})$. The former expression (40) may be considered as a weighted mean of the control, calculated for the sample, where the Q_{y_v} are playing the rôle of the weights. Remembering that by a proper choice of the origin of co-ordinates, we have reduced the value of the population weighted mean

$$Y = \frac{\sum \Sigma (M_{y_v} v y)}{\sum \Sigma (M_{y_v} v)} \quad . \quad . \quad . \quad . \quad (41)$$

to zero, we see that the above result would justify the principle of purposive selection, if the new weights Q_{y_v} were proportional to the weights used in (4); thus if we had

$$Q_{y_v} = \frac{m_{y_v} (M_{y_v} - 1)}{(M_{y_v} - m_{y_v}) \sigma^2_{y_v}} = \frac{m_{y_v} v}{C} \quad . \quad . \quad . \quad (42)$$

C being a constant. Solving (42) with regard to C we get

$$C = \frac{M_{y_v} - m_{y_v}}{M_{y_v} - 1} v \sigma^2_{y_v} \quad . \quad . \quad . \quad . \quad (43)$$

It is easily seen that the right-hand side of (43) may be constant

when $m_{y_i} = 1$ and if the values of $\sigma^2_{y_i}$ are independent of y and inversely proportioned to v ; thus when the hypothesis H_1 is satisfied. Obviously this is not the only condition under which (43) is constant, but it is difficult to formulate any other hypothesis which would concern the unknown values of $\sigma^2_{y_i}$.

The analysis of the formula (39) might be carried a little further, but the considerable size of the present Note and the results already obtained suggest that this may be superfluous.

The conclusions which were obtained above may be summed up as follows:

(a) The estimate of Gini and Galvani is unbiased only if the very limiting hypothesis H' is satisfied.

(b) This estimate is the best linear estimate when another still more limiting hypothesis H_1 is satisfied. This hypothesis consists in the assumption that the variation of x between districts included in each second order stratum, π_{y_i} , depends only upon the value of v and is such as could arise if the districts were random samples from the population studied. This condition is hardly ever satisfied.

(c) If the hypothesis H' is true, then the principle of purposive selection of districts so as to keep the value of the sample weighted mean of the control equal to its population value, is justified when the hypothesis H_1 is true. The dependence of the weighted mean on the system of weights being only slight, it may be assumed that this principle is approximately satisfied even if the hypothesis H_1 is not exact. Other conclusions which may be considered as corrections to the principle of purposive selection, may be drawn from the formula (39).

Whether it is likely that the hypotheses H' and H_1 are justified and whether the divergencies in this respect will seriously influence the accuracy of the results of the application of the purposive selection method, must be considered in any special case.

It will be useful to finish this Note by a numerical illustration of the assumptions involved in the hypotheses H , H' , and H_1 . The following three tables give data concerning three populations π_1 , π_2 , and π_3 of districts. Each population is subdivided into two first order strata, according to the values of the control $y = -1$ and $y = +1$. Each first order stratum is in its turn subdivided into two second order strata according to the size of the districts $v = 1$ and $v = 6$. (Obviously the units in which the number v of persons included in a district is measured, is of no importance. One unit may be, for instance, 10,000 individuals.) The Tables I, II, III, give the values of the character x for each district in a stratum (these, according to notation used in this Note, are denoted by u_i), their arithmetic mean \bar{u} , and their variance σ^2 .

TABLE I.
Population π_1 .

$y = -1.$		$y = +1$	
$v = 1.$ Stratum I.	$v = 6.$ Stratum II.	$v = 1.$ Stratum III.	$v = 6.$ Stratum IV.
$u_1 = -4$ $u_2 = -1$ $u_3 = +2$	$u_1 = -2$ $u_2 = 0$ —	$u_1 = -2$ $u_2 = +1$ $u_3 = +4$	$u_1 = 0$ $u_2 = 2$ —
$\bar{u} = -1$ $\sigma^2 = 6$	$\bar{u} = -1$ $\sigma^2 = 1$	$\bar{u} = +1$ $\sigma^2 = 6$	$\bar{u} = +1$ $\sigma^2 = 1$

TABLE II.
Population π_2 .

$y = -1.$		$y = +1.$	
$v = 1.$ Stratum I.	$v = 6.$ Stratum II.	$v = 1.$ Stratum III.	$v = 6.$ Stratum IV.
$u_1 = -2$ $u_2 = 0$ —	$u_1 = -4$ $u_2 = -1$ $u_3 = +2$	$u_1 = 0$ $u_2 = +2$ —	$u_1 = -2$ $u_2 = +1$ $u_3 = +4$
$\bar{u} = -1$ $\sigma^2 = Q^{-1} = 1$	$\bar{u} = -1$ $\sigma^2 = Q^{-1} = 6$	$\bar{u} = +1$ $\sigma^2 = Q^{-1} = 1$	$\bar{u} = +1$ $\sigma^2 = Q^{-1} = 6$

TABLE III.
Population π_3 .

$y = -1.$		$y = +1.$	
$v = 1.$ Stratum I.	$v = 6.$ Stratum II.	$v = 1.$ Stratum III.	$v = 6.$ Stratum IV.
$u_1 = u_2 = u_3 = -2$ $u_4 = u_5 = u_6 = 0$ —	$u_1 = -6$ $u_2 = -3$ $u_3 = 0$	$u_1 = u_2 = u_3 = 0$ $u_4 = u_5 = u_6 = 2$ —	$u_1 = 0$ $u_2 = 3$ $u_3 = 6$
$\bar{u} = -1$ $\sigma^2 = 1$	$\bar{u} = -3$ $\sigma^2 = 6$	$\bar{u} = +1$ $\sigma^2 = 1$	$\bar{u} = 3$ $\sigma^2 = 6$

It will be seen that for all three populations $X = Y = 0$. Owing to the fact that y has only two different values, the regression of x on y is linear in all populations, and thus all of them satisfy the hypothesis H . The populations π_1 and π_2 satisfy also the hypothesis H' . In fact, the means \bar{u} in the second order strata do not depend upon the value of v . It is not so in the population π_3 . Here in strata corresponding to $v = 1$ the regression coefficient of x on y is

equal to $A_1 = 1$ and in strata corresponding to $v = 6$, to $A_2 = 3$. Thus the population π_3 does not satisfy the hypothesis H' .

The hypothesis H_1 is satisfied only in the population π_1 as here the variances σ^2 are inversely proportional to the v 's.

Consequently, whatever be the numbers, say m_1, m_2, m_3, m_4 of districts selected for the sample from the four strata of the populations π_1 and π_2 so that the sample weighted mean of the control y is equal to zero, the estimate of Gini and Galvani will have its mean in repeated samples equal to $X = 0$. If it were $m_1 = m_2 = m_3 = m_4 = 1$, then in the case of the population π_1 the estimate of Gini and Galvani would be the best linear estimate. Its variance is equal to $\frac{2}{3}$. When sampling in the same way from the population π_2 the estimate of Gini and Galvani would not be the best linear estimate. In fact its variance would be equal to $\frac{11}{3}$. On the other hand, the best linear estimate, which could be derived from the formulæ (36) and (37), namely,

$$\theta' = \frac{\Sigma(Qx)}{\Sigma(Q)} \quad . \quad . \quad . \quad . \quad . \quad (44)$$

would have the variance $\frac{2}{3}$, as previously.

As the hypothesis H' is not satisfied in the population π_3 , it is possible to find such a system of the m 's that the estimate of Gini and Galvani will have its mean value in repeated samples not equal to $X = 0$. Owing to the exceptional symmetry of the population π_3 , there will be many systems of m 's by which the estimate of Gini and Galvani will be consistent. However, let us consider the system $m_1 = 6, m_2 = 0, m_3 = 0, m_4 = 1$. Obviously the sample weighted mean of the control $Y_2 = 0$. There will be only three possible samples corresponding to the fixed system of the m 's depending upon the choice of the district in the fourth stratum. The mean of the estimates of Gini and Galvani, calculated for these three samples will be

$$\bar{X} = \frac{(6)(-1) + (6)(3)}{12} = 1 \quad . \quad . \quad . \quad . \quad (45)$$

and is not equal to $X = 0$. Thus for this system of the m 's the estimate of Gini and Galvani is not consistent. It is easily seen that if there were more districts in each stratum the number of systems, for which the estimate of Gini and Galvani would not be consistent, would be increased. It would be also considerably larger if the structure of the population π_3 were not symmetrical.

DISCUSSION ON DR. NEYMAN'S PAPER

PROFESSOR BOWLEY: There are some who appear to pride themselves on their absence of knowledge of mathematics. I never understood why it should be a matter of pride. I do not think, however, that there are very many who now hold that mathematics is not properly appropriate to the study of statistical problems. This paper will, when it is thoroughly studied, do very much to remove any remaining doubt that the mathematical approach is of fundamental importance. Sampling is at the very root of a great deal of statistical investigation and, as Dr. Neyman points out, of increasing use and applicability; it is therefore of the first practical importance to decide what is the best method of sampling—best in the sense that the best use will be made of the resources at the disposal of the investigator, and that there shall be—if the two are consistent—a minimum expenditure of time.

This paper of Dr. Neyman's will be found to answer most of the questions which relate to the setting out of an investigation by sample. One of the things that is so interesting in it is the analysis of the problems. There is not one perfect method of sampling; the method depends upon the nature of the material which is available or which can be obtained. To me a new suggestion in the classification is this stratified random sampling of groups. In the analysis to which he has referred in much too favourable terms, I had distinguished in the ways he named certain methods of sampling, but in effect I realize that it is precisely the method which he has discussed that I have been driven by circumstances to use or to recommend.

In the Survey of London, the unit was not the family or the person, but the house—the unit which was provided by the directories we had. In the recommendation I had the honour to make with Mr. Robertson to the Government of India, of sampling on a very large scale, the unit suggested is the village. In the recommendations, which had no effect, which I made with regard to the 1931 Population Census, of a method which I had in fact made use of on the 1911 figures, the unit was the householder's schedule, and I suggested that if one took one household in five hundred throughout the country we could deduce some of the results of the Census which now, after three years, we are still waiting for. But that, I think, is not necessarily the method appropriate to all problems, nor do I understand Dr. Neyman to recommend it universally.

I am surprised that he thought that when in 1925 I examined the problem of representative sampling for the International Institute of Statistics, I gave equal importance to that method, as I defined it, and to others. Certainly I thought I damned it with very faint praise at the end of the summary of my report. I agree that it is difficult to formulate, difficult to carry out, and I still think that it is very difficult to get a good estimate of the precision of the result, except in rather unusual cases.

The second problem, after discussing the material and defining the best method of sampling, is to get a definite estimate of the precision of the sampling in the sense that when one has a result, one

knows that it can be trusted, without defining that term, to 1 per cent. or 1 shilling, or whatever it may be ; and it is partly because of that necessity that a common method, partly intuitive, of choosing the sample from the obvious—of taking the mode rather than anything else—is hopelessly faulty, because not only is there difficulty in obtaining an average, but there is no means that I know of obtaining precision.

This method of stratification, so far as it differs in precision from purely random sampling, gives an improvement in precision. If, in fact, one has made a stratified selection and writes down the statement of the precision as if it had been purely random, then one is on the safe side. I have myself generally been content to let it go at that for two reasons : (1) that it is very difficult to measure the additional precision due to stratification in ordinary material—at any rate it is a very lengthy business ; and (2) (of quite a different nature) I have had to explain and try to justify the methods of sampling to non-technical readers, and therefore I have been obliged to leave out a great deal that Dr. Neyman would have put in. But I have endeavoured to be on the safe side, and what I have neglected I know to be unimportant.

This process of stratification can be thought of or applied in various ways. In London we took the simplest way, taking one house in thirty, forty, or fifty, right through the directory, so that the houses we examined, if plotted on a map of London, would be regularly distributed in proportion to the density of the area and every region would be included. But in that way, I think it must appeal to everyone who studies the problem.

A new point that comes out in the paper is that a selection of the units to be examined for one purpose is not necessarily the best for other purposes. As the selection has generally to be made once and for all, that becomes an important consideration in selecting the method to pursue. I am glad that the general recommendation for this kind of purpose is this random stratified sampling.

To give an example in this case in London, if we take a house, we take one, two, or three families. The family is not selected at random, and within the family the persons are not selected at random. If co-existence in one case gives positive correlation in one instance, it may be negative in another, and similarly with relationship between persons in the family. The effect of this is difficult to estimate. My point, however, would be that we must secure a selection that would minimize the influence of these unknown correlations, and one method would be to make our samples sufficiently large to make them unimpaired by the most unfavourable hypothesis.

After Dr. Neyman's very courteous references to my work on the subject, it is somewhat ungrateful that I feel it my duty to criticize the theory of probabilities in Section II, part 1, and I am very glad Professor Fisher is present, as it is his work that Dr. Neyman has accepted and incorporated. I am not certain whether to ask for an explanation or to cast a doubt. It is suggested in the paper that the work is difficult to follow and I may be one of those who

have been misled by it. I can only say I have read it at the time it appeared and since, and I read Dr. Neyman's elucidation of it yesterday with great care. I am referring to Dr. Neyman's confidence limits. I am not at all sure that the "confidence" is not a "confidence trick." Put in a simple form I think the method is as follows:—Given that in a sample of 1,000 taken at random, there are 1 in 10 with the defined quality, and given that the population from which the sample was drawn contained any proportion between 120 and 80 per thousand, then the chance of such an occurrence is less than one in twenty (approx.). Actual figures, of course, do not matter. That margin between 120 and 80 per thousand in the assumed population is shown on the vertical of the confidence belt in the very illuminating graphs which Dr. Neyman has given. Does that really take us any further? Do we know more than was known to Todhunter? Does it take us beyond Karl Pearson and Edgeworth? Does it really lead us towards what we need—the chance that in the universe which we are sampling the proportion is within these certain limits? I think it does not. I think we are in the position of knowing that *either* an improbable event has occurred *or* the proportion in the population is within the limits. To balance these things we must make an estimate and form a judgment as to the likelihood of the proportion in the universe—the very thing that is supposed to be eliminated. I do not say that we are making crude judgments that everything is equal throughout the possible range, but I think we are making some assumption or we have not got any further. I do not know that I have expressed my thoughts quite accurately, but it is not a thing that has occurred to me for the first time this evening; it is the difficulty I have felt since the method was first propounded. The statement of the theory is not convincing, and until I am convinced I am doubtful of its validity.

I regret that in opening up that subject I have distracted attention from Dr. Neyman's paper, but since he has made that an integral part of his paper, I think it a proper occasion on which to make this kind of statement.

With reference to my formula, quoted in Section IV, equation 24, I must admit that the original passage is obscure. In Dr. Neyman's notation and with only one control, my estimate would be *

$$X^1 = X^2 + (r_{ax} - r_{ay}r_{y1})\sigma_x \cdot \sigma_a/\bar{a}.$$

where the α 's are the weights attached to the x 's in the weighted average. The second term is zero, if there is no correlation between the weights and the divergencies, e 's, from the linear regression equation.† In other cases, κ should be regarded as attached to the error term negatively, since the weighted average of the e is not zero, but $-\kappa$. The formula is then "consistent." I am not, however,

* The complete formula in the notation I used may be written

$$X = X_u + \{\sigma_x \cdot R_x / R_{11} \cdot \sigma_a / \bar{a} - E\}$$

where

$$R_x = r_{ax}r_{au}r_{av} \dots r_{ax} \mid r_{au} \dots r_{1z}r_{av} \mid \dots$$

† There is considerable correlation in Table I in Dr. Neyman's paper.

at all sure that the particular hypotheses underlying my treatment are the best ; it was in some way pioneer work, and I should have been astonished if no improvement should have been made in course of time.

I wish to propose a hearty vote of thanks to Dr. Neyman for his very important paper.

DR. E. S. PEARSON: I have great pleasure in seconding this vote of thanks to Dr. Neyman and welcoming him here among us to-day. I think we are all very glad that as one of our Fellows from abroad he has been able to take the opportunity of being in England to read a paper before us.

I should like to try to express in a few words what appears to me to be the essential contribution to statistical method that Dr. Neyman has made in this paper and in other work that he has done. In the past thirty or forty years the development of mathematical statistics has been an extremely rapid one ; it has been associated with all the excitement of discovery, the discovery of the power of new tools in the solution of a great variety of problems. But in this rapid progress intuition was sometimes at fault ; the tools used were not always the best tools, nor was it always very clear what was the meaning of these tools, nor why one tool should be used rather than another. In the last few years there has been a determined effort to clear away some of this uncertainty from our statistical reasoning. The process is not complete ; it is still to some extent in the stage of controversy and discussion, but there are fundamentals that are emerging surely and steadily.

In this process many of us owe a great deal to Professor R. A. Fisher for the stimulus we have gained from wrestling with the ideas he has put forward. If I purposely use the word "wrestling," Professor Fisher will, I think, take no exception when I add that the stimulus is all the greater because it has been necessary to wrestle.

Stimulated by these ideas, as he has frankly admitted, Dr. Neyman has brought a very real contribution of his own into the field of statistical inference. For example, although in the present paper it may be regarded as only a side issue of the main subject, the approach to the problem of estimation outlined on pp. 563-567 and in Appendix I is something of very great interest. This conception of the problem of estimation is not exactly Professor Fisher's conception, but it seems to me that some of the interest lies in just those points where there are differences. I do not, however, think that this is the right place to discuss the doubts regarding confidence or fiducial intervals raised by Professor Bowley: they need to be cleared up, but that perhaps can best be done with pencil and paper at a table.

Returning to the main subject of the paper, I think the chief emphasis lies on the importance of logical planning in any investigation: the particular problem considered is that of estimating certain characteristics of a heterogeneous population from a limited sample. In doing that we have to consider, if we can, how best to take a sample, how to obtain our estimate, and what measure of

reliability to place on that estimate. To answer these questions certain assumptions regarding the unknown population are necessary, and it is important to employ a method of sampling and of estimation which will reduce these unavoidable assumptions to a minimum, and at the same time to make perfectly clear their precise implication. I do not think that this problem can be solved in any way except by the introduction of mathematics. Of course mathematics alone are not adequate, but I believe the highest level of statistical craftsmanship is only reached when, in planning an investigation, we attempt to formulate in precise, and therefore mathematical, terms the framework of hypothesis on which our final inference is to be based. It is towards this level that Dr. Neyman is pointing the way.

The special problem of the paper and other investigations of this kind has been to estimate the average value of some character in the population. This is the form of sampling problem that has presented itself to many investigators.

I would like, however, before I sit down to suggest that there are many cases in which a method of representative sampling is needed, where the average is not going to be sufficient; where it is necessary, in fact, to estimate in some way the nature and degree of heterogeneity in the population. This is perhaps not an easy problem, as we have first to determine what is the most appropriate measure of heterogeneity in a particular case.

Let me illustrate this by shifting from human populations to a population of bricks in a kiln. Owing to the arrangement of firing, the quality of the bricks varies very considerably from one part of the kiln to another. We measure various characters of those bricks, one being their strength; this though of less importance in itself is correlated with important properties of weathering. What do we want to know about the batch of bricks from the kiln? The precise average strength is of much less importance than the uniformity and in particular the lowest strengths which may be met. In determining what procedure of sampling to employ, we have first to decide what index or indices of uniformity will be of most value to us, and then to decide by what rules of sampling and calculation the most reliable estimates of these indices can be obtained.

Another illustration is that of fertilizers which may be sold in bags, the bags being drawn from a large silo in which the material is stored. Since a time element is present in the filling of the silo, there may be lack of uniformity in the quality of material. Here I think the percentage constituents of the standard fertilizers are laid down by law; for example, it may be that the nitrogen content must not be less than, say, 12 per cent. The producer wants, therefore, to be sure that he will not be summoned because the quality in one bag is found to be below that level. It is important for him to get a measure of the average nitrogen content, but it is also necessary for him to have some sampling scheme which will give him reasonable assurance that he is not sending out bags in which the content is less than a certain amount, and also that there are none in which it is too high. He must find some representative method of testing.

A final case is that of cement. There the ordinary test is to take portions of the cement from different parts of the bulked mass, mix and quarter them, and finally submit a small sample to chemical analysis. The result will give an idea of average quality but nothing more. Yet what is of most importance to the user, because it affects his technique in the mixing and setting of concrete, is the uniformity of the material. Again, therefore, some method of representative sampling is wanted which will give some idea of uniformity, not only of average.

These are problems of the future, but I believe of not so very far distant a future. In solving them a method of representative sampling should be planned, based on a sound statistical framework. This does not mean, of course, that the mathematics will be presented to the manufacturer or British Standards Institution, any more than they were presented by Dr. Neyman to the Polish Institute for Social Problems, but I hope they will be there underneath as a foundation.

DR. ISSERLIS said that it was related of Sylvester that while he was Savilian Professor of Geometry at the University of Oxford, when he had discovered some recondite result, he would walk out of his rooms, dressed adequately or otherwise, buttonhole the first milkman or postman he met in the street, and hold on to that button until his victim confessed that he had been convinced by Sylvester of the truth of the theory he had discovered. Dr. Neyman had combined in one paper views on the philosophical foundations of statistical method with an exposition of an important technical problem. Each of them would have sufficed for a paper, but it was his choice to treat the two in one.

Professor Bowley, who was an expert in both, and who had been a teacher of a generation both in the theory and application of statistics, and who had been particularly the exponent of this technical problem, had referred only very briefly to the second subject, which happened to come first in the paper.

Dr. Isserlis felt that it was necessary for someone to face up to the task of trying, without the use of any mathematics, to say what it was that was found to be puzzling in this kind of philosophy, and to see where they stood. The Society had had experience in that very room of people who were more fortunate than the mathematicians. The economists, men like Mr. Hawtrey, who were accustomed in their scientific life to do without the shorthand of a special technique such as mathematics, came and spoke to their colleagues, who were experts in finance and economics, without the use of technical language, and some of their friends sat aghast at such mastery, whereas their colleagues like Sir Alfred Flux and Mr. Macrosty lapped it up like milk.

He would like briefly to refer to the thing that was worrying him, and he would try to make it clear without mathematics. There was a classical theory of probability, based on certain definitions and experiences, which told how to measure and express one's lack of full conviction in certain matters. There were two things: one might

know what was the state of affairs in a general population, and ask what was one likely to get in particular cases? One might be convinced, for instance, that pennies such as were provided by the Mint were fairly symmetrical, and on the basis of that it might be said that the theoretical probability of heads was so and so, say 50 per cent. It might then be said, supposing a coin was tossed 100 times, what should one expect? Should there be surprise if there were only 30 heads, or if there were 90 heads, or should one expect to get about 50? Without any mathematical technique it was perhaps sufficient there to say that there was an *a priori* probability of one-half.

But there was the converse problem. A coin had been tossed 100 times and fallen heads 100 times. What kind of a universe of coins had it come from? Had it come from that kind of universe of coin in which the side with the head was more likely to show up than the side with the tail?

The classical theory provided us with a method which, when limited in its application to the field for which it was intended, was perfectly legitimate. According to this theory, if we knew the *a priori* probabilities, that the penny was an Epsom Downs penny, or that it was an ordinary Mint penny, equally likely to fall heads or tails, or if we knew that it was a penny three times more likely to fall heads than tails,—then if 70 heads had been observed in 100 trials, we could say what were the respective probabilities that the penny was an ordinary penny or an Epsom Downs penny.

The criticisms which had been made of the so-called theory of inverse probability and of Bernoulli's theorem had always rested not on the accuracy of the theory itself, but on the correctness of its application, because in most cases these things were not known *a priori* at all.

Given the actual probability in the universe, it was possible to make probability statements about the sort of thing one was likely to get in a sample. These probability statements usually provided a measure for the probability that a certain inequality should be true. Referring to Equation No. 4 in Dr. Neyman's Appendix I, in that equation x was something that belonged to the observed sample, and it was imagined there that we knew for the moment the particular property of the universe.

His own criticism of that particular equation, and of the whole structure placed thereon, was that it was nothing new; it was not a departure from the various earlier attempts that had been made. What was actually done was this: A particular θ was chosen; an inequality was written down, and more values of θ were chosen. In each of these inequalities, ϵ , which occurred on the right-hand side of the equation, occurred in the definition of inequality on the left side, and had been left out of the equation by Dr. Neyman. When all the points which arose from all the inequalities which could be got by considering all permissible values of θ had been marked, it would be found that we were no further than the man who said, "Let us suppose that the *a priori* probability in the universe is distributed in a particular way. Let us suppose that it fulfils a

certain law." Some had tried to avoid the difficulties by saying, "We can get general results not by assuming that the *a priori* probability satisfies a certain law, but merely by assuming that it is continuous," which meant that if the chance of a penny being exactly symmetrical were so and so, the chance of the penny being nearly symmetrical would be nearly that. As a matter of fact that assumption was equivalent to the absence of gaps among the points on Dr. Neyman's curves; others had tried to follow out the consequences of assuming that the *a priori* probability was continuous near a certain point. All these attempts were rather beating about the bush because the problem was incorrectly stated. When we said that if the probability in the universe were p , then the probability of a certain sample would be x , we were specifying the probability of a certain inequality. It was a matter of elementary algebra to start from that and to say that the inequality so specified, which said that X must be between certain limits in terms of θ and ϵ , led to another inequality which said that given x , θ must lie within certain limits also dependent upon x and ϵ , and that there was a probability for that. The philosophical idea at the bottom of that was rather difficult because we were not now speaking of a probability, but of the probability of a probability. We measured the probability of the truth of the statement that a certain inequality had a particular probability. A hundred years ago mathematicians tried to sum an infinite number of terms in a series, and talked about the ratio of two quantities which ultimately vanished. They happened to be good mathematicians and to have a very sound intuition, and most of their results were correct and had ultimately survived. We had learned that they were occasionally led into a morass, and we said, "Mathematicians cannot perform an infinite number of operations, but can make precise statements about certain inequalities," and it was time that people recognised that while certain probabilities could not be evaluated, correct statements of type $P(F^{(u)})$ could usefully be made. It was possible to go on to higher things, and talk about probabilities of the third or higher orders and still remain in the region of the old subject. The principle to follow was that entities should not be multiplied beyond necessity. This was an argument against belts of confidence and so on, if, as a matter of fact, they only expressed probabilities of statements of the same kind as those which had been made in the past. Dr. Isserlis felt that perhaps he had been wrong, and that he ought to have followed the lead set by Professor Bowley and not trench on mathematics. To try and state mathematics either without chalk or with a minimum of chalk was perhaps a hopeless task. He apologized if he had made himself in any way unintelligible; if something he had meant to say had emerged, he must be satisfied.

PROFESSOR FISHER said that the problem of sampling played an important part in Agricultural Research. It was, indeed, in Experimental Agriculture that an adequate technique, bringing out the different aspects of the sampling problem, and displaying comprehensively exactly how these different aspects were interrelated, was

first developed. In the luminous account which Dr. Neyman had given of the sampling technique, as applied to economic researches, which had itself, perhaps, been influenced by his personal experience in Agricultural Science, one of the features which had interested him most had been the parallelism between the processes he advocated (and the reasons he gave for them) on the one hand, with the corresponding processes and reasons which had been developed by agricultural research workers in this country.

His own contact with the subject had been gained at Rothamsted, where he had the pleasure of collaborating with a succession of brilliant plant physiologists, under whom, and especially under Drs. Maskell and Clapham, the technique was gradually perfected. As in agricultural sampling theoretical considerations were at their simplest, the logical connection between the means employed and the inferences which might validly be drawn were conspicuously clear; it might thus be useful if he gave an outline of the hierarchy of five successive subdivisions used in the sampling of an agricultural experiment. Exactly the same problems discussed by Dr. Neyman could be simply illustrated in this manner.

The smallest unit that need be considered, the unit of *measurement*, as it might be called, consisted, in the case of a cereal crop, of, perhaps, 10 inches or 25 centimetres measured along a drill row. Again, it might consist of a single plant, as with potatoes or sugar beet. For simplicity he would adhere to the cereal crop. A number of units of measurements, usually four, fixed in relative position, but not necessarily adjacent, constituted a *sampling unit*, which would, therefore, contain in all one metre length of drill row, taken, however, in practice, from four different rows. Since the parts of a sampling unit were fixed in a relative position, the positions of all were determined simultaneously by a single act of random sampling, *i.e.* by the choice, by a physically random process, of the particular sampling unit used from among all those available in the *sampling area*. Two or more sampling units were obtained in this way from each sampling area, each being located independently by a fresh act of randomization. It was essential that there should be at least two independently located sampling units in each sampling area, since it was from the differences between these, or the variances among them, if they were more than two, that the error of sampling was estimated. The variance among the units of measurement within the same sampling unit served a different and subsidiary purpose. It was essential to the study of what structure or size the sampling unit should have, and by analysing the variance within and among sampling units, one could ensure that the sampling units were so chosen as to give the maximum precision in return for the labour expended. But once their size and structure were chosen, this analysis could throw no further light on the interpretation of the experimental results. The error of random sampling, on the other hand, should be ascertained with high precision from every experiment to which the sampling method was applied, for on it one relied for judging of the *number* of sampling units which could with advantage be taken from the growing crop. A usual and convenient number was 32 for each experi-

mental plot. The plot would, therefore,* either constitute a single sampling area yielding 32 sample units, or, perhaps, be subdivided into quarters each yielding 8, or at most into sixteenths each yielding 2 sampling units.

Before proceeding to the higher members of the hierarchy, it might be useful to indicate a sociological parallel. The sampling unit might be thought of as a family (or as a house, or as a registration district). The sampling area might be thought of as a stratum of such families when they were stratified with respect, say, to earnings. The plot might be thought of as all the families of a given occupational group in a given area, irrespective of their earnings. Then the subdivision of the agricultural plot into sampling areas played the same part in increasing the precision of the ultimate estimates as the stratification of an occupational group according to their earnings. They were, however, ultimately concerned to compare the agricultural plot with other plots which had received different agricultural treatments, just as one might be concerned to compare the morbidity of an occupational group with that of other occupational groups. The sampling was not an essential part of this comparison, but only a convenient means of measurement, which one was concerned, in the first place, to make sufficiently precise.

In an agricultural experiment designed to compare, say 6 different treatments, 48 plots might be assigned to the experiment, and, after dividing the experimental area into 8 compact blocks, each containing 6 plots, these 6 plots should be assigned, strictly at random, to the 6 experimental treatments. This process of experimental randomization could not, unfortunately, be imitated in sociological enquiries. If it could, more than was known would certainly be known about cause and effect in human affairs. But within this limitation the experiment was strictly parallel to one involving a comparison of 6 occupational groups in, say, 8 different towns. In a well-designed experiment, however, the mathematics were simplified, and all anxiety was avoided in respect to different systems of weighting. Dr. Neyman advocated, wisely, in his opinion, the system which he ascribed to Markoff, though this was in essence the system of Gauss. It must be remembered that if the variances from the different populations were not, on a plausible expectation, to be considered equal, one seldom had prior knowledge or experimental evidence sufficient to make the P_i of Dr. Neyman's equation (8) properly speaking known numbers. This seemed to Dr. Fisher a real difficulty, if one wished to speak of the method as the best possible, though it was no obstacle if, as reasonable beings, statisticians were content that it should be a good or valid method. The subdivision into blocks made clear the fact that sampling error was not the only kind of error which had to be considered. Ultimately the validity of the equations must depend upon the concordance of the evidence from the different blocks.

It would be expected that he should comment on those applications of inductive logic which constituted so illuminating and refreshing an aspect of the evening's paper. All realized that problems of mathematical logic underlay all inferences from observational material. They were widely conscious, too, that more than 150 years

of disputation between the *pros* and *cons* of inverse probability had left the subject only more befogged by doubt and frustration. Recently, however, some research workers, working in the apparently abstract realms of the theory of estimation, and the logical bases of tests of significance, had become increasingly confident that, when properly stated, rigorously exact, though, of course, *uncertain* inferences might be drawn from observational or experimental data. In a word, the confidence of the advocates of inverse probability could be confirmed, that valid conclusions of the kind sought could, sometimes, be drawn with assurance, while the arbitrary assumptions upon which from the time of Laplace onwards such inferences had been supported could be rejected as unnecessary. The particular aspect of this work, of which Dr. Neyman's paper was a notable illustration, was the deduction of what Dr. Fisher had called fiducial probability. Dr. Neyman did not use this term, which he suggested had been misunderstood, but he used instead the term "confidence coefficient." Dr. Fisher thought Dr. Neyman must be mistaken in thinking the term fiducial probability had led to any misunderstanding; he had not come upon any signs of it in the literature. When Dr. Neyman said "it really cannot be distinguished from the ordinary concept of probability," Dr. Fisher agreed with him; and that seemed to him a reason for calling it a probability rather than a coefficient. He qualified it from the first with the word *fiducial* to show that it was a probability inferred by the fiducial method of reasoning, then unfamiliar, and not by the classical method of *inverse* probability. Dr. Neyman qualified it with the word *confidence*. The meaning was evidently the same, and he did not wish to deny that confidence could be used adjectivally. They were all too familiar with it, as Professor Bowley had reminded them, in the phrase "confidence trick." Still fiducial was, perhaps, on purely formal grounds, the better adjective.

Dr. Neyman, as he had explained, differed from Dr. Fisher in the relative importance he attached to the two stages in which he had attempted to develop a theory of estimation, independently of all assumptions as to probability *a priori*, namely, the earlier approach through the notions of likelihood and quantity of information, as compared with the later development of the notion of fiducial probability. This difference was not entirely one of perspective. Dr. Fisher's own applications of fiducial probability had been severely and deliberately limited. He had hoped, indeed, that the ingenuity of later writers would find means of extending its application to cases about which he was still in doubt, but some limitations seemed to be essential. Those who had followed the earlier parts of the story would have no difficulty in perceiving these, but there might be pitfalls for those who interested themselves only in the later chapters. In particular, he would apply the fiducial argument, or rather would claim unique validity* for its results, only in those cases

* Naturally, no rigorously demonstrable statements, such as these are, can fail to be true. They can, however, only convey the truth to those who apprehend their exact meaning; in the case of fiducial statements based on inefficient estimates this meaning must include a specification of the process of

for which the problem of estimation proper had been completely solved, *i.e.* either when there existed a statistic of the kind called *sufficient*, which in itself contained the whole of the information supplied by the data, or when, though there was no sufficient statistic, yet the whole of the information could be utilized in the form of *ancillary* information. Both these cases were fortunately of common occurrence, but the limitation seemed to be a necessary one, if they were to avoid drawing from the same body of data statements of fiducial probability which were in apparent contradiction.

Dr. Neyman claimed to have generalized the argument of fiducial probability, and he had every reason to be proud of the line of argument he had developed for its perfect clarity. The generalization was a wide and very handsome one, but it had been erected at considerable expense, and it was perhaps as well to count the cost. The first item to which he would call attention was the loss of uniqueness in the result, and the consequent danger of apparently contradictory inferences.

In the second place, Dr. Fisher had limited his application to continuous distributions, hoping, with more confidence in this case, that the limitation might later be removed. Dr. Neyman removed this limitation, but at the expense of replacing inferences that stated the exact value of the fiducial probability by inequalities, which asserted that it was not less than some assigned value. This also was somewhat a wide departure, for it raised the question whether exact statements of probability were really impossible, and if they were, whether the inequality arrived at was really the closest inequality to be derived by a valid argument from the data.

Thirdly, Dr. Neyman proposed to extend the fiducial argument from cases where there was only a single unknown parameter, to cases in which there were several. Here, again, there might be serious difficulties in respect to the mutual consistency of the different inferences to be drawn; for, with a single parameter, it could be shown that all the inferences might be summarized in a single probability distribution for that parameter, and that, for this reason, all were mutually consistent; but it had not yet been shown that when the parameters were more than one any such equivalent frequency distribution could be established.

Dr. Fisher said that here he ought to point out that Dr. Neyman did him too much honour in ascribing to him the establishment of "Student's" distribution. It was "Student" himself who took the really novel step, which had in fact revolutionized the theory of errors. He showed, in the particular case he treated, that it was possible to find a quantity, which was known to them as "Student's t ," having a frequency distribution independent of all unknown parameters, and being at the same time expressible as a function of one only of these parameters, together with other quantities directly observable, and,

estimation employed. But this process is known to omit, or suppress, part of the information supplied by the sample. The statements based on inefficient estimates are true, therefore, so long as they are understood not to be the whole truth. Statements based on sufficient estimates are free from this drawback, and may claim a unique validity.

therefore, known with exactitude. That, as it seemed to Dr. Fisher, constituted the real revolution. All that he had added to it was to "studentize" a number of analogous problems, and to exploit the logical advantages of the position to which he showed the way. It was the more essential that he should make this clear since "Student" was himself far too modest a man to claim, perhaps even to believe, how much he had done for the advance of statistical theory.

The criticism as to the mutual consistency of the different possible inferences did not affect the value of Dr. Neyman's advice on the sampling problem. He stressed it here only because it was just this question of consistency which had led a succession of mathematical writers to reject the theory of inverse probability, and he had no wish to see fiducial probability follow the same course.

The following contribution was received from PROFESSOR OSKAR ANDERSON after the Meeting :—

Dr. Neyman has referred to the enquiry into farming conditions in Bulgaria. As I am responsible for the scientific method applied in it and for the main lines of its organization (the technical execution rested with Dr. Stefanoff, and, of course, with the Chief of the Bulgarian Statistical Office, Dr. Kiranoff), I would like to be permitted to make a few remarks.

The process of fixing the villages to be examined was indeed, in the case of the Bulgarian Enquiry, a difficult one and took a relatively long time. Our opinion was that, for our type of selection, *this* is the central problem and the key of the whole work. We began by picking out all villages in which some special form of farming was highly developed (such as tobacco, roses, rice, silkworms, grape vines, etc.). These formed 13 groups containing about 1,000 villages. The remaining 4,000 villages of Bulgaria, forming a much more homogeneous mass, were divided into 5 climatic regions, and each of these in its turn into 3 physical regions—villages on the mountain slopes, villages in the foothills and villages of the plain. The uniformity of the composition of each group was checked. We then chose for our sample some villages of each group in such a manner that they contained about *one-fiftieth* of the farms of the group, which in their turn gave, for the census data of 1927, the same distribution of the size of estates (in 15 categories !) as that of the whole group from which they were taken. This preliminary choice was then carefully checked by comparing the means of the characteristics of the sample with the means for the whole of Bulgaria *for all data provided by the census of 1927*. It was found, after some corrections in the first choice, that in at least 18 directions out of 19 the agreement became very satisfactory *) This is confirmed by 19 tables and diagrams in the Bulgarian *Bulletin de Statistique*, Number 8, 1934, a copy of which is now in the Library of this society. We tried also to reach a more or

* The only exception is the area of artificial meadow—entirely a *quantité négligeable* in Bulgaria. Some slight discrepancies in the area of vineyards can be easily explained by the existence of vineyards in urban areas (Varna, Plevna, etc.).

less equal distribution of the selected villages on the territory of Bulgaria.

Dr. Neyman finds that there is only one detail in our Enquiry about which he is not certain whether it is justifiable: viz. the purposive manner of selecting the villages from the above 28 "strata," instead of purely random sampling. He thinks "That the variability of farms and villages is also a character of their population which may be of interest." This character, however, would be biased in the sample.

My reply is:—

(1) Our chief object was to determine a great number of general means for the whole of Bulgaria (of 1934) and *not* to measure the variability of any characteristic, and

(2) It can be shown that, owing to (a) the very small scale of Bulgarian farming, (b) the uniformity of each of the 28 groups, and (c) the relatively large number of villages in the selection (100), and (d) the approximately linear character of the correlation between the size of farms, and most of their other characteristics—the variability of the farms would not be sensibly biased in a sample containing in any case more than 18,000 farms; and as to the variability of the villages, it is already well known to us.

Without going into mathematics, let us consider the following simple example. Let our problem be to determine the average length of the *right* arm of those present in the Annual Meeting of the Society. Leaving stratification on one side as an unnecessary complication of our example, the method of random sampling would consist in a selection by chance of, say, 10 members of the audience, measuring their right arms and calculating the mean. But suppose that we know *beforehand* that the mean length of the *left* arms of the whole group present is, say, 28 inches: if then we again select 10 members of the audience whose left arm is of or about this length, then Dr. Neyman will agree that it is most probable that the new mean length of *right* arms (estimated by a "purposive selection") will be more accurate than the former mean (estimated on a purely random sample). But, if our selection were based, *e.g.* on the mean colour of ties worn by members of the audience, the result would be much less useful. In the Bulgarian Enquiry, I think, the analogy was much closer to control by length of left arm than to control by colour of ties.

Why did we use purposive selection and not random sampling, which I also personally prefer? The reasons are very simple—time and money. Given our very detailed programme, the short time and the limited qualified personnel available in Bulgaria, it was by no means possible to extend the enquiry over more than 100 villages. The work had to be finished in one month, before the beginning of farming operations, and, of course, we could not drive our relatively small staff over mountains, through forests, water and snow in early spring and on Bulgarian roads to, say, 1,000 villages, which would be necessary in the case of a purely random sampling of them, even if stratified.

The Bulgarian Statistical Office hopes to publish the results of our

enquiry at the end of this year. The report will contain a theoretical introduction and all possible controls on the general lines indicated by the formulæ of Prof. Bowley, and also of Dr. Neyman.

To conclude : I fully agree with Dr. Neyman that with random sampling the statistician is on firmer ground and feels more confidence than with purposive selection. But I differ from him in thinking that there *are* occasions where the latter is both more economical and more exact. The conditions for a good purposive selection are, firstly, that the object of the enquiry should possess some qualities similar to those of the Bulgarian or Danish * example, and secondly, that all the circumstances of the enquiry must be very carefully planned and checked. I agree that both are far from being always possible; and in any case, in my opinion, the first thing which is needed for a successful issue is by no means "good luck," as Dr. Neyman says, but a perfect knowledge of the object and sound statistical reasoning.

DR. NEYMAN, in reply : I am most grateful to all those who have taken part in the discussion of my paper. Extensive discussion is very useful, not only to listeners and readers, but also to the author, because it shows him what is properly done in his paper and where he is at fault.

The present discussion has shown, I think, (i) that my criticism against the method of purposive selection was sufficiently convincing, and (ii) that the sections concerned with the confidence intervals and the problem of estimation were not. Out of the four eminent statisticians who have honoured my paper by discussing it, there was only one who defended the method of purposive selection. And then this was not a defence of the method itself, but rather of a separate inquiry in which a mixture of the two methods of stratified sampling by groups, and of purposive selection was used. Professor Bowley stated that he distrusted the method of purposive selection, even in 1925, when he prepared his Report to the International Statistical Institute.

Therefore, as far as the main subject of my paper is concerned, I have to argue only with Professor Anderson, and I am glad that the argument will concern only details, not my main thesis. In fact, his statement that, "with random sampling, the statistician is on firmer ground and feels more confidence than with purposive selection," shows that we are in perfect agreement on the main point. Our agreement extends even further than Professor Anderson seems to think, as I agree with him that in *certain* cases the method of purposive selection may be applied with great success. I even suggested a class of problems in which this is the case (see the last paragraph of the main text of the paper, page 589). But we are relying on good luck if we apply the method without sufficient evidence of its validity.

It is a very interesting fact that, in Bulgarian conditions, the regressions of many characters of farms on their size are linear. In

* See Adolph Jensen, "Purposive Selection," *Journ. Roy. Stat. Soc.*, Vol. XCI, pp. 541-547.

Poland we have found* that many regressions, for instance the regression of the gross income on the size and on the outlay, cannot be represented by a plane, and that the partial regression of the income on the outlay depends very much upon the size of the farms. Probably the general farming conditions in the two countries are very different. The application of Professor Anderson's method in Poland would lead to biased estimates of the means sought.

With regard to the problem of determining the average length of the right arm of those present at the meeting, which has been quoted by Professor Anderson as an instance in which the method of purposive selection should be applied, I should like to notice that it is a special case of the class of the problems indicated in the last sentence of my paper (page 589) as suitable for the application of this method. So here again we are in agreement. I cannot agree, however, that the accuracy of an unbiased estimate will be increased if we purposely select individuals with the length of the left arm approximately equal to its average. The solution of this question follows directly from the formulae, already fully discussed in textbooks,† to the effect that the greater accuracy is obtained (i) by minimising the difference between the sample and the population means of the control, and (ii) by maximizing the sample standard deviation of the control.

* See: (1) W. Pytkowski: *The Dependence of the Income in small Farms upon their Area, the Outlay and the Capital invested in Cows*. Biblioteka Pulawska, Warsaw, 1932.

(2) K. Iwaszkiewicz: "*La rentabilité de l'étendue, du fonds de roulement et du capital investi en vaches dans les petites exploitations rurales*." Kwartalnik Statystyczny, t. IX, Fascicule 1, 1932, Warsaw.

(3) M. Iwaszkiewicz: "*Recherches statistiques sur la rentabilité des engrais artificiels dans les petites exploitations rurales*." Kwartalnik Statystyczny, t. X, Fascicule 2-3, 1933, Warsaw.

All these publications are to be found in "Statistica"—the collections of the papers prepared in the Biometric Laboratory, Nencki Institute and in the Statistical Laboratory, Central College of Agriculture, Warsaw.

† See, for instance (1) M. Ezekiel: "*Methods of Correlation Analysis*," New York, 1930, pp. 252—255.

(2) R. A. Fisher: "*Statistical Methods for Research Workers*," London, 1932, pp. 115—117.

Finally, the solution may be obtained from a suitable adjustment of formulae (36), (37) and (39) in the Note III of the Appendix, p. 603.

The mentioned formulae are:—

$$Y' = \bar{y} + a(X - \bar{x})$$

$$\text{and} \quad \mu^2 = \frac{\sigma_y^2(1 - r^2)}{n - 2} \left(1 + \frac{(X - \bar{x})^2}{\sigma_x^2} \right)$$

where \bar{x} and \bar{y} mean the sample means of the two variables, σ_x^2 and σ_y^2 the sample variances, X the known population mean of x , Y' —the estimate of the population mean of y , μ^2 —the estimate of the variance of the same, a —the sample regression coefficient of y on x and r —the sample correlation coefficient. As the difference $|X - \bar{x}|$ is practically never zero, in order to attain the greatest accuracy of the estimate Y' , it is advisable to try to minimize $|X - \bar{x}|$ keeping σ_x as large as possible. In order to do so, it is necessary to include in the sample individuals both with very large values of x and with very small ones. Then the difference $|X - \bar{x}|$ will be small and σ_x large, and μ^2 will approach its minimum value $\frac{\sigma_y^2(1 - r^2)}{n}$.

I did not expect that the sections of my paper dealing with the new form of the problem of estimation would play so large a part in the discussion. It is at least gratifying that the criticisms were so divergent that one of the speakers could say that everything in it is doubtful, and another that it is nothing new. I considered it necessary to include these sections in my paper, as otherwise it would not be complete, and it would be justifiable to ask why I am not troubling to consider the problems which Professor Bowley termed the inverse problems.

Detailed comments on all questions raised in the discussion on the confidence intervals would require too much space. In fact, to clear up the matter entirely, a separate publication is needed. As this is in preparation, I shall limit myself only to one or two remarks, which may clear away certain obvious misunderstandings.

It has been suggested in the discussion that I used the term "confidence coefficient" *instead* of the term "fiducial probability." This is certainly a misunderstanding. The term confidence coefficient is not synonymous to the term probability. It means an arbitrarily chosen value of the probability of our being right when applying a certain rule of behaviour. The relation of the concept of the confidence coefficient to that of probability may be compared to the relation between the concepts of the "price" and "money" (this, if we accept the definition of the "price" as "a certain amount of money which has been fixed by the merchant . . ."). Perhaps a still better comparison is provided by the terms "rate of interest" and "money." The analogy here is less superficial than one would expect. Banks are working at a certain rate of interest, which is being fixed once for a longer period, and just this constancy led to the introduction of the term "rate of interest." The validity of probability statements in the new form of the problem of estimation, which has been here so extensively discussed, depends on the permanent use of a system of confidence intervals. This system as a whole (not separate intervals) corresponds to a fixed probability that our predictions are correct, and certainly there is a definite advantage in having a special term to denote this value of the probability. It would allow us, for example, to use the convenient expressions like the following:—the seed-testing station in X is working with the confidence coefficient .95, etc.

Another important misunderstanding, which I think it useful to clear up now, is contained in the following remarks of Professor Bowley concerning the theory of the confidence intervals:—“(a) Does it really lead us towards what we need—the chance that, in the universe which we are sampling, the proportion is within these certain limits? I think it does not; (b) I think we are in the position of knowing that *either* an improbable event has occurred, *or* the proportion in the population is within the limits.”

I have marked the two sentences with letters (a) and (b) as I shall have to comment on them separately.

The sentence (a) contains the statement of the problem of estimation in the form of Bayes. Simple algebra shows that the solution of this problem *must* depend upon the probability law *a priori*.

Therefore, if all we need consists in "the chance that, in the universe which we are sampling, the proportion is within given limits," we certainly cannot go any further than it is already known.

In so far as we keep to the old form of the problem, any further progress is impossible. It would be possible only if the previous writers on the subject had been wrong. The present progress is connected with the fact that, *instead* of the mathematical problem stated in the sentence (a), we are solving some other mathematical problem, say (α), which (i) has a solution independent of any arbitrary assumptions concerning the probability law *a priori*, and (ii) may form a basis for the practical work of a statistician concerned with problems of estimation.

Now what is the difference between the problems (a) and (α)? Both of them are dealing with probabilities, but these probabilities apply to different events. In the problem (a) we ask about the probability that a character of the sampled population lies within certain limits, while in the problem (α), we are interested in the probability of committing an error when applying constantly a certain rule of behaviour. The former probability proved to be dependent on the probabilities *a priori*. On the other hand, it was possible to invent such systems of statements about the values of population characters that the probability of being wrong in these statements is a fixed one, whatever the probabilities *a priori* (the law of which may be continuous or not, without restriction). This circumstance, that in the problem of confidence intervals the probability statements concern the results of our behaviour, not the populations and that they relate to this given rule of behaviour, not to the properties of samples to which this rule is being applied, is very important.

Next, let me remark on the sentence (b) in the criticism of Professor Bowley. I shall simplify the position, assuming that we want to determine the proportion, p , of black balls in a bag, and for this purpose we intend to draw as many as $n = 3$ balls (with replacement—for simplicity). The number of black balls in the sample will be denoted by X , which may have the values 0, 1, 2, 3. The sentence (b) of Professor Bowley assumes that we actually have the sample drawn and that, for instance, $X = 3$. Having got so far, we certainly cannot tell much about the probability of p having any definite value. In fact, all we can say is that either an improbable fact occurred, or p has a rather large value. But what is done in the method of confidence intervals is different. We start our reasoning, as it were, before drawing the sample. Or again, we assume that this is not the only one sample with which we shall have to deal. We notice that the sample may provide us only with one out of the four possibilities $X_1 = 0$, $X_2 = 1$, $X_3 = 2$ and $X_4 = 3$. Having noticed this, we fix a rule as follows:—

If in the sample which we shall draw, X will have the value

	$X = 0$,	then we shall state that	$0 \leq p \leq \pi_1''$
If	$X = 1$,	"	" $\pi_2' \leq p \leq \pi_2''$
	$X = 2$,	"	" $\pi_3' \leq p \leq \pi_3''$
	$X = 3$,	"	" $\pi_4' \leq p \leq 1$

We are aware that the statement which we shall make, in applying this rule to the result of actual sampling, may be wrong or may be true. We calculate the probability, P , that the statement will be a true one, and try to arrange the system of values of the π 's so as to have $P \geq .95$, whatever the probability law *a priori*.

In this way, having a sample and knowing that $X = 3$, we cannot tell any more about the value of p than Professor Bowley has stated. On the other hand, making statements following the rules set out above, we know something important about the results of these statements: the probability that we shall be wrong is then $\leq .05$.

The last misunderstanding I should like to clear concerns the recognition of the merits of the work of "Student." I certainly recognize and appreciate it very much. If I call a distribution "Student's" distribution, it means clearly that I attribute its discovery to "Student," and not to anybody else. This does not prevent me from recognizing and appreciating the work of Professor Fisher concerning the same distribution.

I am very grateful to all present at the meeting for the kind reception of my paper.

MISCELLANEA.

CONTENTS.

	PAGE
Pre-war Fluctuations of Profits in the Cotton-Spinning Industry. By H. CAMPION	626
The Value of Remittances Abroad for Cinematograph Films. By S. ROWSON, M.Sc.	633

PRE-WAR FLUCTUATIONS OF PROFITS IN THE COTTON-SPINNING INDUSTRY.

By H. CAMPION.

UP to recently little attention has been paid to the movement of profits during the trade cycle. It has been generally inferred that the profits of industry rise and fall with changes in business conditions, but how the movements occur has remained rather obscure. The difference between the movement of profits and the movements of the determining factors of quantity of goods sold and of selling prices was pointed out by Sir Josiah Stamp in his paper before the Royal Statistical Society in 1918. In a more recent investigation, Dr. W. H. Coates laid stress on the variation in profits between individual years. It was to confirm the impression that profits change considerably from year to year, and also to examine the effects of these fluctuations on the pre-war development of the industry, that further evidence was sought in regard to the movement of profits in the cotton spinning industry in the thirty years before 1913. For this purpose a sample of 260-300 companies controlling 60-70 per cent. of the coarse and medium section of the spinning industry was taken for the years 1906 to 1913, and for the years 1886 to 1906 a sample of about 100 companies representing about 20-30 per cent. of that section of the industry.

Information regarding profits and losses in the cotton industry before the war is perhaps more ample than for other industries, since the companies raised a large proportion of their capital locally and, therefore, details of their financial accounts were well known. For some firms particulars of the amount of profits and losses are available back to the middle of the nineteenth century, but the amount of information available in the middle of that century is too scanty to justify its use and the investigation was, therefore, started from 1886.

For every year since 1886, details of the amount of paid-up capital employed, the net profit or loss, and the dividend paid were obtained for each company. From this information the average

net profit or loss per £1,000 of paid-up share capital in all the companies was computed. The number of companies, however, changed slightly from year to year and care was taken to see that the omission of a company in any year was not due to its unwillingness to declare a loss. The size of the sample during the earlier years was well maintained and the constituent companies remained substantially the same. Following the boom of 1906-7, which brought into existence a number of new public companies, details became available for a larger number of firms. Altogether, particulars were obtained for over 260 companies, but for some it was only possible to ascertain the amount of paid-up share capital and the dividends. In order to include them in the sample, their net profits were estimated on the basis of the experience of the other concerns by comparing the amount of dividends paid and of paid-up capital.

Profits and Losses of the Cotton-Spinning Industry (1886-1913).

				Per £1,000 of Paid-up Share Capital	
Year.				Net Profits £	Net Losses £
1886	...	...	..	—	17
1887	...	...	..	25	—
1888	...	...	...	75	—
1889	...	...	...	65	—
1890	...	...	...	106	—
1891	...	...	...	3	—
1892	...	...	...	—	31
1893	...	...	..	—	20
1894	...	...	..	—	4
1895	...	...	...	17	—
1896	...	...	..	12	—
1897	...	...	..	48	—
1898	..	..	..	84	—
1899	...	...	..	112	—
1900	...	...	..	106	—
1901	...	..	..	93	—
1902	...	..	..	—	1
1903	...	...	..	—	13
1904	...	..	..	9	—
1905	...	...	..	192	—
1906	...	...	..	196	—
1907	..	...	..	352	—
1908	...	...	..	178	—
1909	...	..	..	—	77
1910	...	...	..	—	100
1911	...	...	..	8	—
1912	...	..	..	148	—
1913	...	...	..	173	—

The difficulties of constructing the series and the impossibility of testing completely the selection of the sample leave the results to some extent hazardous. The reliability of the sample, moreover, depends on certain interpretations. Most of the companies—at least, up to 1906—were Oldham firms and the series of profits is, therefore, more representative of the coarse and medium spinning section than of the spinning industry as a whole. Secondly, the companies made up their trading accounts at different dates and the series relates to accounts generally for years ending September. Thirdly, it was the custom for spinning mills before the war not to call up all their share capital but to use loans on which they paid a fixed rate of interest of 3 or 4 per cent. per annum. The effect of this practice is to exaggerate the apparent movement of profits, when calculated on paid-up share capital only, since loan interest had to be paid in both good and bad years. No complete information exists as to the total amount of loan capital employed, but the available evidence shows little change in the proportion from year to year, which remained on the average £3 of loans to £5 of paid-up share capital.

On the basis of these figures, the average net profits realised in pre-war years was 7 per cent. on paid-up share capital. On all capital employed, including loans, the return was less than 5 per cent. The whole amount of profits earned was not distributed in dividends; a certain proportion, which, of course, varied from year to year, was retained in reserve. On the showing of the companies taken the proportion of dividends paid to shareholders was about 70 per cent. of the total profits earned.

The changing prosperity of the spinning section expressed so forcibly in the fluctuations of profits was also seen in the movements of spinning margins and of output, which provided the main sources of changes in profits. For comparison with profits an annual index-number of the margins between the prices of American middling cotton and standard twist yarns was compiled (the twelve months from October to September being taken) and an annual index-number of exports of cotton piece-goods was used in the absence of reliable figures of yarn production. Since the coarse and medium spinning section depends to a large extent on overseas markets for piece-goods, changes in exports may be taken as broadly representative of similar changes in yarn output. Figures for calendar years were used in the case of exports, since the period of time between the primary processes of spinning and the export of the finished piece-goods is about two to three months. Possible contrary movements in the demand from the home market and from the export market were probably not of sufficient importance during

the period to reduce the reliability of the index-number very much on that account.

Index-Numbers of Spinning Profits.

Margins and Exports of Piece-Goods (1896-1905 = 100).

Year.				Profits.	Margins.	Exports of Piece Goods.
1886	...	...	...	— 27	108	91
1887	...	...	..	39	91	92
1888	...	...	..	117	98	94
1889	...	...	..	101	108	94
1890	...	...	..	165	91	96
1891	...	...	..	5	139	92
1892	...	...	..	— 48	130	91
1893	...	...	..	— 31	110	87
1894	...	...	..	— 6	101	100
1895	...	...	..	28	106	94
1896	...	...	..	20	104	98
1897	...	...	..	74	99	90
1898	...	...	..	131	119	98
1899	...	...	..	155	130	102
1900	...	...	..	165	107	94
1901	...	...	..	145	64	101
1902	...	...	..	— 1	81	100
1903	...	...	...	— 20	82	97
1904	...	...	...	14	94	105
1905	...	...	..	297	120	116
1906	...	...	..	305	106	117
1907	...	...	...	546	165	118
1908	...	...	...	277	109	104
1909	...	...	...	— 120	90	107
1910	...	...	...	— 156	89	113
1911	...	...	..	12	102	125
1912	...	...	...	229	126	130
1913	...	...	...	268	118	133

1. Losses are shown by negative signs.

2. The margins are between the prices of American middling cotton and 40's twist yarns up to 1902 and between the prices of American middling cotton and 32's twist yarns from 1902 to 1913. The figures have been adjusted to form a continuous series so far as possible.

The three series have cyclical movements which roughly coincide. Profits show the widest fluctuations, partly owing to the way in which the index-number of profits was compiled. The broad agreement between the movements of the three series is perhaps an additional check on the reliability of the index-number of profits, since it is unlikely that in any particular year profits would show any important rise or fall without a similar movement on the part of either exports

or margins. In 1891 and 1892 margins appear to have been unusually high, but these are explained in part by the increase in wage rates in 1891, the threatened dispute in the spinning section following the enforcement of this increase, and the high nominal quotations for cotton yarn during the weeks of the industrial stoppages which followed. Wage rates were reduced again in 1893.

There was, however, a noticeable difference between the movements of the index-numbers of exports and of margins about the index-number of profits. In the years when profits were rising exports were increasing more rapidly and the height of margins marked the period of largest profits. On the other hand, the drop in margins brought down profits. In 1890 and 1900, when profits were high, margins were reduced quickly at the first signs of declining export trade. The fall in profits was most severe in those years when there was a fall both in exports and in margins. In 1908, for example, the index-number of exports declined 14 points, margins 56 points, and profits 270 points. But, in general, the fall in profits was checked by a gradual increase of exports. Thus, margins appear as the main factor determining the fluctuations of profits, although exports exerted the major influence during the early and later stages of the cycle.

The early fall and the slow recovery of margins may have been in part due to the fact that these margins only measure the additions the spinning section makes to the price of raw cotton for its services and not the total spread between the price of raw cotton and the export price of finished piece-goods. Owing to the horizontal organization of the industry and to competition between different sections, the price margin of the spinning section may vary as a proportion of the total spread between the price of raw cotton and the export price of finished piece-goods at different periods of the trade cycle. Again, since one of the effects of a depression may be to reduce the marginal costs of the industry, profits could be made without restoring margins to their previous level. Perhaps the importance of this factor was not so great in cotton spinning as it would be for a less mature industry. Further, an upward trend in demand—such as was shown by the rise in exports between 1886 and 1913—would bring the industry more quickly out of a depression. Finally, margins may have shown little ability to rise owing to the fact that they were never allowed to fall to the extent they might have done. An agreement to limit output during a depression, the working of organized short time (as was the practice in the spinning section before the war), or perhaps a concurrence of a fall in the price of raw cotton indirectly fixes a higher level of margins than otherwise would have prevailed.

Possibly the main explanation of this difference of movement between margins and exports arose from the fact that while the productive capacity of the industry was never substantially reduced during the depressions, every period of rising profits led to the installation of new machinery.

Index-Numbers of Spinning Profits and Spindleage (1896-1905 = 100).

Year.	Profits.	Number of spindles.
1886	— 27	93.1
1887	39	93.0
1888	117	93.7
1889	101	94.0
1890	165	96.3
1891	5	97.7
1892	— 48	97.5
1893	— 31	98.0
1894	— 6	97.9
1895	28	96.9
1896	20	95.5
1897	74	94.9
1898	131	95.7
1899	155	96.8
1900	165	97.9
1901	145	101.2
1902	— 1	101.3
1903	— 20	102.6
1904	14	104.4
1905	297	109.7
1906	305	119.4
1907	546	125.3
1908	277	129.5
1909	— 120	131.1
1910	— 156	131.7
1911	12	132.0
1912	229	132.8
1913	268	134.7

1. No allowance is made for the increasing proportion of ring spindles installed, especially since 1900.

Exports of piece-goods increased at the average rate of 1.36 per cent. a year from 1886-1913 and for spindleage the annual rate of increase was 1.38 per cent. While productive capacity followed exports over the period, every upward movement of profits was the signal for the erection of new mills and the installation of additional machinery. The rise in profits in 1905-7, for example, led to a large increase in the number of spindles, which probably aggravated the subsequent decline in margins and profits, especially as new

machinery was being brought into use throughout the depression of 1909-11. Indeed, some of the post-war difficulties of the cotton-spinning industry due to surplus capacity might be traced to the fact that the industry had been built up to meet the record demand from overseas markets in the immediate pre-war years.

Tests to determine whether the decreases in the number of spindles which did take place were due to the smaller-sized firms or the more unprofitable concerns going out of business were not conclusive, if only because of the relatively small number of companies which did go out of business during the years 1886-1913. There seemed, however, to be no direct relation between the profits earned and the technical size of the firms. The largest firms made the largest total profits, but the correlation between the size of the firm expressed in equivalent spindleage (ring spindles counted as equal to one and a half mule spindles) and its profits earned per £1,000 of capital employed or per unit of capacity was not sufficiently high to justify any general statement.*

* In view of the unsatisfactory results of these pre-war enquiries, similar tests were made in 1930 and 1931, when a large number of spinning firms went out of business during the depression. Enquiries covering firms controlling 90 per cent. of the spindles in the spinning industry showed that the reduction in yarn production between 1929 and 1931 was secured not by all firms each restricting output or by only firms working at a low rate of capacity ceasing production. The firms which went out of business were drawn both from those working up to and also below capacity. They included both large and small firms.

THE VALUE OF REMITTANCES ABROAD FOR CINEMATOGRAPH FILMS.

By S. ROWSON, M.Sc.

[Read at the British Association, Section F, Aberdeen. Sept. 11th, 1934.]

THE paper which I am privileged to bring to the notice of this Section is the first contribution, known to me, ever made to any economic or statistical body or journal, towards the study of the economics of popular entertainment in this country. It is high time that this omission be rectified; and I can, from my own experience, promise with great confidence that an exhaustive survey of the social and economic effects and values of organized and merchanted popular entertainment will produce notable and surprising results of considerable sociological importance. We shall then have acquired authoritative evidence of the place which public entertainment occupies in the life of the community, its importance as an occupation to many tens of thousands of people, and as an investment for many tens of millions of capital. All this is a mystery now; and I hope they who can will determine that it shall be a mystery no longer.

In choosing "The Value of the Remittances Abroad for Cinematograph Films" for this contribution, I acknowledge the subject occupies, at first sight, only a very narrow corner indeed of the entire field of organized and merchanted entertainment. It has, however, the particular merit, that the discussion of the various factors that lead to the final conclusion gives an opportunity for getting glimpses of a considerable range of economic activities which the would-be student of the film industry will encounter. Indeed, like the famous naturalist, Cuvier, who could reconstruct an entire prehistoric monster from the study of a single fossil bone; and like the philologist who in my undergraduate days succeeded in deriving more than one thousand years of the history of the English language from the study of about half a sentence in the Gospel of St. Matthew (Tyndale's text); so also it would be possible to describe, almost completely, the entire structure of the film industry in all its branches—with some sidelights on the film industries of Hollywood, France, and Germany—from a corresponding elaborate and intensive examination of the various items which enter into the determination of the remittances abroad on account of films. It is not my intention to extend my survey on this occasion so far afield as this.

It is proper that I should first indicate the fact that when I attacked the problem some years ago at the invitation of the Board of Trade, wildly exaggerated figures were in circulation, generally in support of a mischievous political attack on certain sections of the

industry. For example, one person, formerly connected in a very important executive post with the industry, had, in order to support his hostile propaganda against Sunday opening of cinemas, published fantastic calculations of the effect which the general opening on Sundays might have on remittances to America. In one political leaflet he stated that it would result in an increase of the volume of remittances abroad (mainly to America) by no less a sum than £4 million in excess of the amount remitted now in respect of the rest of the week. If Sunday performances alone could produce a sum of this magnitude, it would not be unfair to assume that the other six days during which the cinemas are, on the average, open for at least 50 per cent. more hours each day cannot produce less than between £20 million and £30 million. In fact, as will be shown later, so large a sum is certainly four to five times as much as we are justified in inferring from the available evidence.

The British Trade Returns are completely uninforming on the facts of this trade, as the following figures for 1933, kindly supplied to me by the courtesy of the Board of Trade, show.

TABLE I.

IMPORTS.

Positive films	.	.	.	.	.	.	£100,800	
Negative films	.	.	.	.	.	.	83,600	
								£184,400

EXPORTS.

Positive films	.	.	.	.	£158,800	
Negative films	.	.	.	.	11,200	
						£170,000

RE-EXPORTS.

Positive films	.	.	.	.	.	12,100	
Negative films	18,700	
						<u>30,800</u>	
							<u>200,800</u>

Excess of Exports over Imports	.	.	.	£16,400
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Were there no other grounds for questioning these figures one would be found in the returns for "negatives." The value of the imports from America—the principal source of imported films—is given as £35,000 and the footage as 1,959,000, which represents an average of 4·3*d.* per foot. In fact the values of films imported from America may in very exceptional cases fall as low as about 4*s.* per foot, but the values of probably more than 95 per cent. of them range from £1 to £20 or £30 per foot. The same kind of misleading figures occur throughout the whole of the trade returns for films—imports, exports, and re-exports from and to various countries—and consideration ought to be given by the Board of Trade to methods for making the returns accord more closely with the facts.

The explanation of the present returns is to be found in the present

structure of the film business. This business is, in the main, in the hands of so-called "renting" companies whose general task it is to acquire films from various sources and then to distribute them among exhibitors who can be induced to rent them for exhibition in their cinemas. Out of 476 imported films registered in 1933 for distribution and exhibition in Great Britain, no fewer than 330 were so registered by nine American-owned companies, directly representing the leading American film-producing companies. These 330 films include practically all the most important subjects, and their value in the aggregate must be at least 90 and probably 95 per cent. of the total. All the films imported for these American-owned companies are handled by them as agents, and the sums later remitted to their American principals comprise contributions to the cost of the films and also the profits of the renters here in their business of distribution. There is no attempt, however, by the importing companies to divide the remittances into "cost" and "profits" respectively. If they were called upon to "declare" the value on importation, the task would be an almost impossible one. Expert and experienced though the importers here and the exporters in New York are, the film as an article of commerce is intrinsically incapable of having its value predetermined. That value depends on a host of intangibles, each one elusive and incalculable, such as salesmanship, showmanship, public taste, degree of novelty, time when released, and so on. The expert might, of course, form some judgment of values. But he would have to view the film first, and even then his estimates would most probably be wrong. As an expert he would no doubt be reasonably accurate in the long run; but this would not be a satisfactory basis for individual declarations of value, such as could be checked by the Customs officials.

This indefiniteness of value is fundamental to the industry as at present constituted, and therefore the importer or consignee wisely limits his declarations of value to the actual cost of the prints, or, in the case of negatives, to a token figure of from 4*d.* to 6*d.* a foot. There have been suggestions from time to time for the substitution of *ad valorem* duties on importation for the present specific rates, but no practicable suggestion has yet been forthcoming for indicating how the values are to be determined, and, what is at least as important, how the Customs officials are to check these values. Direct methods for ascertaining overseas remittances for films are not available. The actual number of remitting companies is very few; less than ten companies would probably account for more than 95 per cent. of the entire amount. But any enquiry from these companies would certainly draw a polite but firm refusal. The information is probably ascertainable also by the Bankers' Clearing House; but it is virtually certain they would not take any steps to collate such information as

may be in their possession. We are left, therefore, with the responsibility for devising an indirect method. The mind no longer jibs at indirect methods, and experience has taught investigators in a multiplicity of other fields of enquiry, that indirect methods can, and frequently do, give results as accurate and therefore as reliable as by direct methods.

The method I chose was to determine first, the size of the fund in the hands of the section of the trade known as the "renter" or "distributor." It is the renter who is responsible for making the remittance; and I have no doubt that at the present time he does, in fact, remit probably more than 99 per cent. of the sum whose amount we are trying to determine. When we know this sum and deduct from it all known payments, expenses for goods, services, and profits paid or belonging to British companies and persons domiciled here, we are left with a balance which, though it represents only amounts *available* for remittance, can nevertheless be deemed to be, in fact, the sum which will have been remitted. I know of no centre in the film industry where unremitted funds are left to accumulate.

The starting-point of my present enquiry is to ascertain the total expenditure by the public on cinema entertainment. In my opinion, there is, at present, no practicable method of determining this sum other than in relation to the entertainment tax collected. Unfortunately, the Excise Department does not keep separate returns for different entertainments or even of groups of entertainments. I venture, in passing, to enlist the support of this Section and of economists generally, for a request to the Commissioners of Excise to procure a classification of the entertainment tax revenue, both by nature of entertainment and admission price-rate. An immense aid to the study of the economics of entertainment will then have been provided. A very high authority, whose identity I am not at liberty to mention, has made a special investigation of this subject, and our conclusion from a discussion of the results obtained is that the entertainment tax on admissions to cinemas last year (1933) was £6,700,000. This figure is probably correct to within £100,000.

Now what relation has this figure to the total payments? In general the entertainment tax is one-sixth of the total charge. But there are many exceptions. Thus, a 4*d.*, 5*d.*, 6*d.*, and 7*d.* ticket carries each a 1*d.* tax, amounting therefore to 25, 20, 16·7, and 14·3 per cent. respectively. Throughout the main cinema price-scale there are similar variations, except that at no other price than 7*d.* does the proportion fall below 16·7 per cent. How then are we to determine the average ratio between tax and gross payments on taxed seats? Here I am helped from another source. I have been supplied with the detailed analysis of the sale of over 300 million tickets during the first half of this year in more than 2,000 cinemas. For my present purpose,

I think this sample extending to probably more than one-half of the cinema admissions in the country can be regarded as giving the ratio of tax to total payments with a considerable approximation to the truth. The result of this analysis is as follows :—

TABLE II.

Tax Paid. d.	Price of Admission (inc. tax).	Proportion of Admissions at Various Prices (per cent.).
—	1	0.27
—	2	1.48
$\frac{1}{2}$	3	4.35
1	4	5.31
1	$4\frac{1}{2}$	0.00
1	5	3.79
1	6	9.64
1	7	18.28
$1\frac{1}{2}$	8	0.59
$1\frac{1}{2}$	$8\frac{1}{2}$	0.02
$1\frac{1}{2}$	9	15.10
2	10	0.09
2	11	0.16
2	12	20.53
$2\frac{1}{2}$	13	0.02
$2\frac{1}{2}$	14	0.14
$2\frac{1}{2}$	$14\frac{1}{2}$	0.10
$2\frac{1}{2}$	15	4.37
3	16	2.40
3	17	0.02
3	18	7.36
4	19	0.00
4	20	0.04
4	21	0.05
4	22	0.36
4	24	2.09
5	26	0.00
5	28	0.05
5	29	0.09
5	30	1.43
6	32	0.00
6	36	0.09
7	42	0.67
8	48	0.00
9	51	0.00
9	54	0.01
10	60	0.07
$11\frac{1}{2}$	69	0.00
12	72	0.06
17	102	0.02
—	Complimentaries	0.57
—	Transfers	0.37
—	Re-admissions	0.01
		100.00

It will be found on working out the ratio of the total payments for admission (*i.e.* the sum of the products of columns 2 and 3) to the total tax-yields (*i.e.* the sum of the products of columns 1 and 3) that the result is exactly six to one. This unexpected result is due entirely

to the 7d. seat, the effect of which at a tax-rate of 14·3 per cent. countervails precisely the amounts in excess of 16·7 per cent. paid throughout the entire range of other seats. Without the sevenpenny seat the ratio is almost exactly $5\frac{3}{4}:1$. The inclusion of the sevenpenny seat which represents seven times the tax, the ratio falls, as stated, to exactly 6:1. We are now in a position to say, therefore, that the aggregate of payments by the public into the cinemas is six times £6,700,000 or £40,200,000, of which £33,500,000 is the amount remaining with the cinema after tax has been paid.

Permit me at this point, and because of its general interest, to digress a little so as to enquire what these figures indicate as the number of annual admissions to the cinemas. The average price per patron indicated in the ticket-sales already referred to is 10·31d. I have good reason for assuming that these ticket-sales apply to about 65 to 70 per cent. of the total cinema admissions, and that on the average the price paid is somewhat higher in the theatres to which they apply than to the balance of 30 to 35 per cent. of admissions in the remaining theatres. If it be assumed that the average admission price in these remaining cinemas is 9·5d., the average for the whole country will be about 10·07d. Over a total payment of £40·2 million this represents 958 million admissions a year, or approximately an average throughout the year of $18\frac{1}{2}$ millions per week. This figure is for Great Britain only. But, in film matters—and despite the separate political existence of the Irish Free State and Northern Ireland—the United Kingdom is still United! The complement of admissions in Irish cinemas is not easy to ascertain, but as the number of cinemas in Ireland numbers about 5 per cent. of the number in Great Britain, and as the average earning power for films in Ireland is generally assumed by the distributors as being worth about 3 per cent. of the total, and the average price of admission is somewhat lower than in Great Britain, we may safely increase the Great Britain totals for admission by about 700,000 per week. This brings the total for Great Britain and Ireland to about 19 $\frac{1}{4}$ million per week. It is a little less than was generally accepted as the number of admissions a few years ago, but except that it has probably not kept pace with the general increase of the population, I doubt if any actual or appreciable change has really occurred in the last few years. Including Ireland, therefore, the net value of the admissions would have to be increased from £33·5 to nearly £35 million for Great Britain and Ireland.

I return now to the main question. The sum of £35 million in the hands of the exhibitors in Great Britain and Ireland has to serve many purposes. It has to pay first for his running expenses—rents, rates, and taxes; salaries and wages; repairs and removals of his structure; advertising and consumable supplies. A large portion of the balance is paid for the show, which consists of the film programme

and in some cases of one or more items—musical, spectacular, or vaudeville. Our concern, however, is : what proportion of the total is payable and paid to the renter or distributor from whom his film programme was acquired ? This proportion varies in special cases between very wide limits. It depends upon many considerations, principally on the bargaining skill of the exhibitor's buying representative and the renter's salesman. I venture to suggest that in no other industry in the world, not even in the bazaars of the East, is the art of bargaining exercised with as great skill as in the selling of films. It led some years ago to a number of very marked trade abuses and, when the Bill which became known later as the Quota Act was passing through Parliament, special provisions were introduced to regulate and restrict the conditions under which films could be traded for exhibition. It is rumoured in the trade, possibly with some justification, that keen salesmanship has been able to find ways to surmount the statutory barriers, and the expectations of Parliament in this respect have been defeated.

While, however, the proportion of the cinema receipts paid for films varies, as I have said, between very wide limits, it came as a surprise to me to find that in most multiple-theatre groups under one ownership or control (technically known as "circuits") there is a tendency for the average over the whole circuit to approximate fairly closely to one another. I have made personal enquiries in respect of several hundred of such theatres in various parts of the country, and I have reason to believe that in the aggregate these represent a good sample for cinemas in general. And the mean value for all these houses is that, of the net receipts after deducting entertainment tax, the proportion paid for films is 33·7 per cent. Against a total net receipts by exhibitors of £35 million (allowing £1·3 million for exhibitor receipts in Ireland on which a contribution is paid to renters in England), this represents a total receipt by renters of £11·8 million.

We have now to estimate and determine the various payments which have to be made or provided out of this fund for goods and services in this country ; the balance will represent the figure we have set out to find. As the number of renters is comparatively small in number, you will appreciate the necessity which has been imposed on me to exercise a certain amount of reticence in the figures I can publish regarding some of my final calculations. The principal payments made by renters out of this fund of £11·8 million are on account of wages, salaries and general overheads, import duties, prints (of films), and advertising (including trade shows), amounting, I believe, to £3·7 million, leaving £8·1 million with the renters. Out of this reduced fund is provided the means for paying for the cost of British films, after allowing for the revenue from abroad derived from exporting British films. I estimate that the value of last year's output of

British films was £2.9 million, to which should be added about £100,000 for the cost of the news reels, apart from the cost of the negative and positive film used in such news reels, making £3.0 million in all. From this sum must now be deducted an export trade already amounting to about £600,000, leaving the net charge for British films as £2.4 million. This leaves £5.7 million still undistributed by the renters. A deduction should now be made from this sum for the profits earned and retained by the British renters on this business, which I believe can be put at £400,000-£500,000. The balance of about £5.3 million represents the sum available for payments on account of imported films. More than 90 per cent. of this sum is remitted by the American companies established here to their parent companies in America, but before the final remittance can be calculated a deduction must be made for income-tax paid by these American concerns here. The amount to be deducted on this last account is obviously unknown to me, but I "guess" it to be about £300,000. This leaves for net remittances to all countries about £5,000,000. If we write back some £500,000 of the total exports of British films which comes from countries other than the United States, we can safely say that the net value of the remittances to the United States in 1933 must have been about £5,500,000.

The following is a tabular statement of these final results :

TABLE III.

	U.S.A. £ (million).	Other Countries. £ (million).	Total. £ (million).
Remittances for foreign films	5.3	—	5.3
Receipts from British films shown abroad	0.1	0.5	0.6
Net remittances abroad	5.2	0.5	4.7

The figure of £4.7 million is my estimate of the net value of the invisible balance of trade in cinematograph films, and consists of £5.3 million of invisible imports and £0.6 million of invisible exports. There are, of course, other remittances, both outwards and inwards, not included in any returns. There are the salaries of British artists abroad and of foreign artists here; the royalties and payments to British authors; and the royalties and other payments in connection with the use of American sound-recording and reproducing machines installed here. I have no way at present of forming any estimate of these amounts, but I have very little doubt that on balance these would account for a further half-a-million of remittances to America.

And there I leave this subject for the present !

REPORT OF THE COUNCIL.

For the FINANCIAL YEAR ended December 31, 1933, and for the SESSIONAL YEAR ending June 19, 1934, presented at the ONE HUNDREDTH ANNUAL GENERAL MEETING of the ROYAL STATISTICAL SOCIETY, held in the Hall of the Royal Society of Arts, John Street, Adelphi, W.C.2, on June 19, 1934.

THE Council have the honour to submit their One Hundredth Annual Report.

The roll of Ordinary Fellows on December 31 last, as compared with the average of the previous ten years, was as follows :—

Particulars.	1933.	Average of the previous Ten Years.
Number of Fellows at end of previous year ...	1031	1040
Number lost by death, withdrawal, or default ...	63	56
New Fellows elected	56	63
Number of Fellows on December 31	1024	1046

Since December 31 last, 35 new Fellows have been elected or restored to the list, and the Society has lost 37 by death, resignation, or default, so that the number on the list, excluding 24 Honorary Fellows, on June 19, 1934, is 1022, against 989 a year ago.

Since June, 1933, the Society has lost by death the under-mentioned Fellows :—

	Date of Election.
*Anslow, the Right Hon. Lord, C.B.	1885
*Avery, John, F.C.A.	1893
Kopf, Edwin William	1927
d Lakin-Smith, Herbert, F.C.A.	1901
*Mabson, Richard R.	1875
*Moncrieff, Robert P.	1917
*Moss, James	1917
Pullar, James, F.F.A., A.C.A.	1911
*Venning Charles H.	1889

* Life Fellow.

d Donor to the Library.

In the Sessional year ending June 19 the deaths of nine Fellows have been recorded. Six were life Fellows, including Mr. Mabson, who was elected over fifty-eight years ago, and Lord Anslow and Mr. C. H. Venning, who had been Fellows for forty-eight and forty-four years respectively. Mr. Mabson will be remembered from his long association with the *Statist* and as an expert in mining finance. The

Society has also to deplore the death of Sir Edgar Harper, the well-known authority on local taxation, who was a Fellow from 1901 until 1933 when ill-health obliged him to resign. Sir Edgar served on the Council for three periods, the latest being during the years 1925–30. An obituary notice appeared in Part I of the *Journal* for this year.

Since June, 1933, the following new Fellows have been elected :—

Astbury, Samuel John, M.A.	Honey, Frederick John Cleverdon.
Barreiro, Luis.	Houghton, Charles Thomas.
Bartlett, Maurice Stevenson.	Hughes, Hubert William.
Beer, Frederick Tidbury.	Jennett, William Joseph.
Brady, John.	Jones, Thomas William, B.Sc., F.C.S.
Brash, Robert William.	King-Hall, Stephen.
Bryant, Margaret Anne.	Kuczynski, Robert René.
Buckland, William Reginald.	Lemon, Dudley.
Campion, Harry.	Lewis, Archibald Harry.
Coomes, Edward George.	Litt, Robertus.
Cotsworth, Moses Brewins.	Madan, Geoffrey.
Cownie, Ivor Thomas William.	Millis, Leonard William Francis.
Crichton, John Roberts.	Mills, Eric, B.A., O.B.E.
Crosse, the Ven. E. Francis.	Norwood, William Joseph Lyndon.
Dale, John Ainsworth, C.B.E.	O'Brien, Patrick Kevin.
Damerell, Norman William.	Peacock, Douglas Henry.
Dixon, Robert Spraggon.	Plant, Prof. Arnold.
Drysdale, Charles Vickery, C.B., O.B.E., D.Sc., M.I.E.E.	Pollock, Kennet.
Dudding, Bernard Phineas.	Rest, Edward Douglas van.
Eveson, Stephen Wilfred, M.R.C.S., L.R.C.P., D.P.H.	Rodgers, John.
Frankland, Ernest George.	Rollit, Dorrell Kaye.
Fricker, Reginald Arthur.	Salman, Mohamed Hassan, M.D.
Gear, Harry Sutherland.	Saunders, Clifford J., A.I.S.A.
Gibson, William Howieson.	Sinha, Haris Chandra, M.Sc., Ph.D.
G'Manie, Fatehchand Tarachand.	Somerfield, Edward.
Goodfellow, Percival.	Stillier, Robert Bernard.
Gooding, Ernest John, B.Sc., Ph.D.	Sykes, Stanley William, A.I.M.T.A.
Gosset, William Sealy.	Taggart, Jack Harry Scott.
Gupta, Om Prasad.	Tanner, Edward Butler.
Haldane-Robertson, Langton.	Tinney, Edgar Brooke, B.Sc.
Hayek, Prof. Friedrich A.	Turnbull, John, F.A.S., A.I.A.
Hirst, Geoffrey, A. N.	Weeks, Hugh.
	Wilsdon, Bernard Howell.
	Yates, Frank, M.Sc.

Representatives of Corporate Bodies :

Attwood, Bedford Gater	representing the J. Walter Thompson Com-
Wallace, B.Sc.,	pany, Limited.
Barrett, William Goods-	representing the United Kingdom Provident
man,	Institution.
Brightman, Rainald,	representing the British Dyestuffs Corporation
	Limited.
Charles, Alfred George,	representing the British Metal Corporation
	Limited.

- Eden, T., M.Sc., A.I.C. *representing the Tea Research Institute of Ceylon.*
 Lawrence, Oliver L., *representing the Royal Institute of International Affairs.*

Honorary Fellow :

Borel, Emile, Professeur à la Faculté des Sciences de Paris.

During the Session 1933–34, 72 new Fellows were elected, and the total number of Ordinary Fellows is now 1022. The satisfactory increase in the number of elections has coincided with a decrease in the numbers lost by death and resignation so that the year of the Society's Centenary is appropriately marked by a net increase in the Fellowship, offsetting the losses of several years preceding.

The Society's financial position is shown in the appendices (A i and A ii), which give the receipts and expenditure during the year 1933. It will be noticed that although the receipts were less than in the preceding year it was found possible to reduce expenditure to an extent which left a favourable balance on the year's working. The general position may therefore be considered satisfactory and to give prospects of improvement in the future.

The Ordinary Meetings have been held in each month of the Session, and the papers read before the Society were as follows :—

1933.

- I.—November 21st ... YULE, G. UDNY, C.B.E., M.A., F.R.S. On some Points relating to Vital Statistics, more especially Statistics of Occupational Mortality.
 II.—December 19th ... DALE, J. A., C.B.E. The Interpretation of the Statistics of Unemployment.

1934.

- III.—January 16th ... CROWTHER, GEOFFREY, M.A. The *Economist* Index of Business Activity.
 IV.—February 20th ... JONES, PROF. J. HARRY, M.A. Exchange Stability *versus* Internal Price Stability.
 V.—March 20th ... LINDSAY, SIR H. A. F., K.C.I.E., C.B.E., I.C.S. India's Trade and Industrial Statistics: Past, Present, and Future.
 VI.—April 17th ... STAMP, SIR J. C., G.B.E., D.Sc., LL.D., F.B.A. Methods used in Different Countries for Estimating National Income (paper opening a Discussion).
 VII.—May 15th ... Continuation of the Discussion initiated by Sir J. C. Stamp, by PROF. A. L. BOWLEY and others.
 VIII.—June 19th ... NEYMAN, DR. J. On the Two Different Aspects of the Representative Method: the Method of Stratified Sampling and the Method of Purposive Selection.

Reference was made in last year's report to the plans for the formation of an Industrial and Agricultural Research Section within the Society. This Section has now come into being, and the titles of the papers read at the four meetings held in this, its first session, are as follows :—

1933.

- I.—November 25th ... PICKARD, R. H., D.Sc., F.R.S. Application of Statistical Methods to Production and Research in Industry.

1934.

- II.—January 23rd ... WISHART, John, M.A., D.Sc. Statistics in Agricultural Research.
 III.—March 8th ... PEARSON, E. S., D.Sc. Sampling Problems in Industry.
 IV.—May 31st ... WILSDON, B. H., M.A., B.Sc. Discrimination by Specification Statistically Considered as Illustrated by the Standard Specification for Portland Cement.

The Council were fortunate in being able to induce Dr. Pickard, F.R.S., of the Cotton Industry Research Association, to read at the inaugural meeting a paper giving a general survey of the ways in which statistical methods can be of assistance in standardizing production, and the size of the audiences which attended at this and the following meetings testifies to the interest taken both by theoretical statisticians and by industrialists and agriculturalists. The papers will be printed in full in the special Supplements to the *Journal*, No. 1 of which, issued with Part II, contained the two first papers, two papers dealing with statistical methods (by A. T. McKay, and O. L. Davies and E. S. Pearson, respectively), and a Bibliography of Agricultural Statistics, by J. Wishart. The second number, which will contain the third and fourth papers read, will appear with Part IV of the *Journal*. Copies of the Supplement will be sent regularly to any Fellow who signifies his wish to receive them.

During the session 1933–34, the sixth since its inauguration, the Study Group, again under the Chairmanship of Miss Iris Douglas, held nine meetings at which papers were read and discussed as follows :—

1933.

- October 10th ... The Chairman. Some Problems of Retail Price Measurement.
 November 14th ... NEUMAN, A. M. Industrial Capacity, with special reference to Coal Mining.
 December 5th ... POLLOCK, W. The Economic Aspects of Life Assurance.

1934.

- January 9th ... SOUTHALL, A. M. Some Notes on the Rate of Interest.

1934

February 13th	...	IRWIN, J. O., D.Sc.	Employment of Statistical Methods in Biological Assays.
March 13th	...	SNOW, E. C., M.A., D.Sc.	Scepticism in Statistics.
April 10th	...	BOWLEY, RUTH.	The Possibility of a Middle-class Budget Enquiry.
May 8th	...	SELWYN, J. B.	Methods of Price Control.
June 12th	...	Annual Meeting and Discussion on the Future of the Group.	

The December meeting was the occasion of the annual joint meeting with the Institute of Actuaries Student Society, which was held this year in the hall of the Royal Society of Arts, this Society acting as host. The Chair was taken by the Rt. Hon. Lord Meston, K.C.S.I., LL.D.

The Society's Centenary, the date of which fell on March 15th of this year, was celebrated during the week beginning April 16th, and the Council invited the members of the International Statistical Institute to hold their Jubilee meeting in London at the same time and to share in the Celebrations as guests of the Society. A full account will appear in Part III of the *Journal*, and only a brief summary need be given here. The Centenary Meeting proper was held in the Great Hall of University College on April 17th and was opened by the Honorary President, H.R.H. the Prince of Wales, with an address surveying the work of the Society. The Centenary banquet took place the same evening, and about three hundred people were present. The week's proceedings had begun on Monday morning when the Earl of Athlone, Chancellor of the University of London, received the members of the International Statistical Institute at University College (which, by the kindness of the authorities, had been placed at the Society's disposal for the week); he gave a brief address on the connection between the University and statistical work. During the following days the members of the Institute were engaged at their own meetings, but in the evenings they participated in the entertainments arranged by the Council. The thanks of the Society are due to the London School of Hygiene and Tropical Medicine, to the Government Hospitality Committee, and to the Lord Mayor and Corporation of the City of London for the receptions held by them on the Monday, Wednesday, and Thursday nights. On Friday a large number of Fellows, Members of the Institute, and their friends were entertained at a ballet performance at Sadler's Wells Theatre. The successful arrangements made by a committee of ladies, presided over by Lady Stamp, for the entertainment during the day of the ladies who accompanied the Members of the Institute, must also be mentioned with gratitude. Finally,

it is to be recorded that a generous grant towards the expenses was made by His Majesty's Government, and that handsome subscriptions were also received from the Royal Economic Society, Barclays Bank, and the Bank of England.

In 1935 the Council will again offer the Frances Wood Memorial Prize for competition. Fellows may be reminded that this prize is offered for the best investigation, on statistical lines, of some problem affecting the economic or social conditions of the wage-earning classes, the subject to be chosen by the competitor.

In the year ended May 31st, 1934, 1,110 works were added to the Library, compared with 1,304 the year before. These figures exclude periodicals regularly received and a number of minor Parliamentary Papers. During the same period 1,414 volumes were borrowed by 708 Fellows, against 1,713 by 794 Fellows the year before.

The Fellows named below (nominated in accordance with By-law 14) are recommended for election as President, Council and Officers of the Society for the Session 1934–35 :—

President.

Professor Major Greenwood, D.Sc., F.R.C.P., F.R.S.

Council.

Sir Percy Ashley, K.B.E., C.B.	Robert Holland-Martin, C.B.
Sir W. H. Beveridge, K.C.B.	Leon Isserlis, D.Sc.
*M. S. Birkett, O.B.E.	H. Stanley Jevons, B.Sc.
J. Bonar, LL.D.	*Prof. J. H. Jones.
Prof. A. L. Bowley, Sc.D., F.B.A.	J. Maynard Keynes, C.B.
Clara E. Collet.	A. W. Waterlow King.
*L. R. Connor, M.Sc.	H. Leak.
*J. Iris Douglas.	H. W. Macrosty, O.B.E.
*W. Palin Elderton, C.B.E., F.I.A., F.F.A.	*Egon S. Pearson, D.Sc.
Dorothy P. Etlinger.	E. C. Rhodes, D.Sc.
R. A. Fisher, Sc.D., F.R.S.	E. C. Snow, D.Sc.
*R. G. Glenday, M.C.	J. Calvert Spensley, O.B.E.
R. G. Hawtrey.	J. W. Verdier, O.B.E.
David Heron, D.Sc.	Harold D. Vigor.
A. Bradford Hill, Ph.D., D.Sc.	John Wishart, D.Sc.

Those marked * were not Members of Council during the preceding Session.

Honorary Treasurer.

A. W. Waterlow King, J.P.

Honorary Secretaries.

H. W. Macrosty, O.B.E.

E. C. Snow, D.Sc.

Leon Isserlis, D.Sc.

Honorary Foreign Secretary.

E. C. Snow, D.Sc.

The abstract of the Treasurer's account of receipts and payments and the balance sheet as on December 31, 1933, together with the report of the Auditors on the accounts for the year 1933, are appended.

Signed on behalf of the Council,

MESTON,

President.

M. GREENWOOD,	} <i>Hon. Secretaries.</i>
H. W. MACROSTY,	
E. C. SNOW.	

APPEN

A.—(i) RECEIPTS AND PAYMENTS ACCOUNT FOR

Year 1932.			RECEIPTS.			Year 1933.		
£	s.	d.				£	s.	d.
			Annual subscriptions :—					
1,459	10	0	For current year (680)	...	...	1,428	0	0
117	12	0	Arrears (47)	...	...	98	14	0
44	2	0	In advance (28½)	...	...	59	17	0
1,621	4	0				1,586	11	0
459	16	4	Dividends and interest (including in-					
823	11	6	come tax refunded)	...	...	435	6	11
5	12	6	Journal sales (including reprints)	...	...	722	19	9
2	0	2	Journal advertisements	...	...	12	0	0
30	0	0	Sales of other publications	...	...	2	14	0
10	10	0	Use of rooms	...	...	90	0	0
3	10	0	Special subscription	...	...	10	10	0
2	16	11	Study Group subscriptions	...	...	5	0	0
			Miscellaneous	...	...	15	10	
2,959	1	5	Total of Ordinary Receipts	...	...	2,865	17	6
126	0	0	Life compositions	...	...	21	0	0
3,085	1	5						
133	7	5	Excess of payments over receipts					
£3,218	8	10				£2,886	17	6

DICES

THE YEAR ENDED 31ST DECEMBER, 1933.

Year 1932.			PAYMENTS.	Year 1933.		
£	s.	d.		£	s.	d.
			Journal :—			
809	5	2	Printing and paper	604	19	0
96	2	6	Reviewing	86	9	4
23	5	6	Reporting	23	18	0
108	17	1	Distribution	88	10	2
15	11	0	Re-purchase of scarce parts ...	4	13	11
1,053	1	3		808	12	5
160	12	1	Meetings (including printing and post- age)	149	6	11
83	3	1	Library books	49	0	10
151	8	5	Library binding	47	1	9
1,004	16	4	Salaries and wages	1,001	10	7
380	0	0	Rent	380	0	0
2	7	6	Land tax	2	7	6
14	4	11	Insurance	14	4	11
98	12	1	Fuel, light and water	83	17	7
36	16	2	House expenses	28	1	1
36	13	9	Repairs to premises	14	12	6
25	17	9	Furniture and equipment (including typewriter and new lamps in 1932)	3	12	9
27	7	4	Postage, carriage and telephone ...	63	1	7
115	14	3	Stationery and miscellaneous printing	92	13	10
—			Research Section expenses	7	18	2
1	8	0	Study Group expenses	4	14	5
7	7	8	Miscellaneous	11	1	1
3,199	10	7	Total of Ordinary Payments	2,761	17	11
—			Centenary expenses	3	9	3
10	13	3	Centenary Fund circulars	—		
8	5	0	Refund to Frances Wood Memorial Fund (amount due from 1931, less advances in 1932)	—		
—			Excess of Receipts over Payments ...	121	10	4
£3,218	8	10		£2,886	17	6

APPENDIX

A.—(ii) BALANCE SHEET

Year 1932.			LIABILITIES.	Year 1933.		
£	s.	d.		£	s.	d.
44	2	0	Advance annual subscriptions ...	58	16	0
104	15	9	Advance Journal subscriptions ...	58	13	0
233	4	3	Sundry creditors	229	18	0
382	2	0		347	7	0
1,640	2	0	Life composition fund	1,640	2	0
			Balance in favour of the Society (exclusive of (1) Books in Library, (2) Journals and other publications in stock, and (3) Pictures, Furniture and Fixtures)			
7,984	1	0		8,087	12	7
£10,006 5 0				£10,075 1 7		

BUILDING FUND (ESTAB

On 31st December, 1932, the Fund consisted of £689 18s. 5d. 3½ per cent. Con during 1933 (£49 7s. 1d.) were invested in £24 4s. 8d. 3½ per cent. Con of £714 3s. 1d. 3½ per cent. (Conversion Loan, and £653 15s. 7d. 4 per cent. tively) being £1,441.

FRANCES WOOD MEMORIAL FUND

On 31st December, 1932, the Fund consisted of £500 4 per cent. Preference During 1933, dividends of £11 5s. were received, and the Fund was postage. Thus at 31st December, 1933, the Fund consisted of £500 30th December, 1933, at 70½, £352 10s.), and £99 14s. 10d. cash in hand.

REPORT OF

“We have examined the foregoing Receipts and Payments Account, Balance Memorial Fund with the Books and Vouchers of the Society and find them opinion, properly drawn up so as to exhibit a true and correct view of the Investments and Cash Balances.”

DICES

AT 31ST DECEMBER, 1933.

Year 1932.			ASSETS.	Year 1933.		
£	s.	d.		£	s.	d.
			Investments, at cost or under :—			
			£2,236 11s. 3d. 2½% Consols (General			
1,185	0	0	Fund)	1,185	0	0
			£10,527 12s. 3d. 2½% Consols (Guy			
5,580	0	0	Bequest)	5,580	0	0
1,299	0	0	£1,841 3½% Conversion Loan ...	1,299	0	0
490	0	0	£500 3½% War Loan	490	0	0
800	0	0	£1169 17s. 6d. 3% Local Loans Stock	800	0	0
			£666 4% 2nd Pref. Stock, L. & N.E.			
100	0	0	Rly.	100	0	0
25	0	0	£266 5% Prefd. Ord. Stock, L. &	25	0	0
			N.E. Rly.			
9,479	0	0	(Market value, £13,167)	9,479	0	0
			Cash :—			
			On deposit			
			On current account			
			In hand			
377	17	10		490	8	2
			Arrears of annual subscriptions re-			
84	0	0	coverable (say 40)	84	0	0
65	7	2	Sundry debtors	12	13	5
£10,006	5	0		£10,075	1	7

LISHED 10TH JULY, 1873).

version Loan, and £630 4s. 5d. 4 per cent. Consols. The dividends received version Loan, and £23 11s. 2d. 4 per cent. Consols, and the Fund now consists Consols, the total value at 30th December, 1933 (at 101½ and 109½ respec-

(ESTABLISHED 13TH MAY, 1920).

Stock, London, Midland & Scottish Railway, and £113 4s. 10d. cash in hand. credited with £5 5s. income tax refunded and debited with £30 for prize and 4 per cent. Preference Stock, London, Midland & Scottish Railway (value at

THE AUDITORS.

Sheet, and Statements in regard to the Building Fund and the Frances Wood to be in accordance therewith. We report that the Balance Sheet is, in our state of the Society's affairs, as shown by the Books. We have verified the

(SIGNED) J. CALVERT SPENSLEY.
A. M. SOUTHALL.
J. O. IRWIN.

APPEN

B.—STATEMENT OF THE CONDITION OF THE SOCIETY

Year.	Constitution.				Receipts.						1 in
	Number of Fellows at end of Year.		Changes during the Year.								
	Totals.	Life Fellows included therein	Gains by Election, &c.	Losses by Death, &c.	Annual Subscrip- tions.	Com- posi- tions. ¹	Divi- dends, Interest, &c. ²	Journal Sales.	Other Items.	Totals.	
1909	825	167	52	82	£ 1,307	£ 84	£ 334	£ 273	£ 42	£ 2,060	
1910	845	172	57	37	1,304	141	420	326	54	2,245	
1911	867	174	62	40	1,415	126	341	308	65	2,255	
1912	854	175	44	57	1,336	105	341	334	41	2,157	
1913	846	174	53	61	1,331	84	341	294	58	2,108	
1914	821	169	39	64	1,281	42	339	271	51	1,984	
1915	772	163	12	61	1,243	63	319	268	32	1,925	
1916	758	163	34	48	1,181	42	284	325	18	1,850	
1917	737	161	40	41	1,186	53	276	311	130	1,956	
1918	761	167	47	43	1,132	222	456	305	3	2,119	
1919	796	172	91	56	1,297	273	276	603	10	2,459	
1920	882	180	123	37	1,373	251	291	730	95	2,740	
1921	946	186	112	48	1,481	231	603	662	39	3,015	
1922	969	187	71	48	1,499	126	454	689	142	2,910	
1923	996	195	66	39	1,476	242	506	739	114	3,075	
1924	1,002	194	68	62	1,638	105	400	666	81	2,890	
1925	1,030	195	79	51	1,611	189	399	807	43	3,049	
1926	1,054	197	77	53	1,619	116	404	780	112	3,031	
1927	1,074	199	62	42	1,665	84	376	792	84	3,001	
1928	1,079	201	56	51	1,680	84	397	748	87	2,996	
1929	1,076	202	61	64	1,804	137	400	866	124	3,331	
1930	1,058	204	50	68	1,663	126	451	1,026	680 ³	3,946	
1931	1,064	208	62	56	1,667	115	452	948	80	3,262	
1932	1,031	210	46	79	1,621	126	460	824	54	3,085	
1933	1,024	205	56	63	1,586	21	435	723	122	2,887	

¹ Carried to Life Composition Fund from 1921 onwards.² Including income tax refunded.³ Exclusive of the Building and Frances Wood Memorial Funds.

DICES

DURING THE LAST TWENTY-FIVE YEARS, 1909-1933.

Payments.							Market Values of Investments at end of Year ³	Year.
Journal.	Meet-ings.	Library, Books and Binding.	Salaries and Wages	Rent	Other Items.	Totals		
£	£	£	£	£	£	£	£	
636	74	99	550	380	315	2,054	12,085	1909
808	90	74	582	380	727 ⁴	2,661	11,210	1910
621	89	104	602	380	576	2,372	10,874	1911
725	85	81	620	380	283	2,174	10,599	1912
658	76	79	632	380	233	2,038	10,092	1913
793	82	88	615	380	361	2,319	9,528	1914
458	64	40	480	380	222	1,644	8,182	1915
516	50	36	492	380	181	1,655	7,702	1916
413	71	54	516	380	199	1,633	7,656	1917
651	91	33	534	380	211	1,900	8,282	1918
774	86	50	645	380	349	2,284	7,672	1919
913	89	99	904	380	454	2,839	6,848	1920
900	110	94	954	380	390	2,828	7,605	1921
983	98	103	1,006	380	755 ⁵	3,325	8,605	1922
922	146	107	1,010	380	445	2,940	8,666	1923
947	127	138	1,022	380	357	2,971	8,962	1924
940	132	116	1,021	380	373	2,962	8,423	1925
1,144	131	98	991	380	366	3,110	8,122	1926
1,213	150	119	899	380	302	3,063	8,375	1927
835	136	104	793	380	517	2,765	8,343	1928
839	150	156	878	380	238	2,741	8,462	1929
841	151	120	864	380	408	2,764	9,636	1930
903	147	206	921	380	376	2,933	9,151	1931
1,053	161	235	1,005	380	384	3,218	12,908	1932
809	149	96	1,001	380	330	2,765	13,167	1933

⁴ Includes £436 for re-decoration, etc., in 1910.⁵ Includes £395 for Catalogue printing in 1922.⁶ Includes £600 from sale of *Times* in 1930.

PROCEEDINGS OF THE ONE-HUNDREDTH ANNUAL GENERAL MEETING
OF THE ROYAL STATISTICAL SOCIETY, HELD IN THE HALL OF
THE ROYAL SOCIETY OF ARTS ON TUESDAY, JUNE 19TH, 1934.

The Chair was taken by the President, the Right Hon. LORD MESTON OF AGRA AND DUNOTTAR, K.C.S.I., LL.D., at 5.0 p.m.

The HONORARY SECRETARY read the circular convening the meeting.

The CHAIRMAN announced that a Guy Medal in Silver had been awarded to Professor J. H. Jones for his paper on Exchange Stability versus Internal Price Stability and for previous papers contributed to the Society's Proceedings.

In presenting the Report of the Council for the financial year 1933 and the Session 1933-34 (which was taken as read) the Chairman referred to the celebration, briefly described therein, of the Society's centenary, and to the fact that the one-hundredth Annual General Meeting was now taking place. Societies, he said, came and went with surprising rapidity, and there were very few which could look back on a record such as that of the Royal Statistical Society. In this way the meeting, though forming no part of the formal celebrations, was a very remarkable occasion in the annals. The history of the Society had been written and the volume in which it had been recorded was in the hands of all Fellows. It had been written with a pious devotion and almost holy fervour, very largely by his friend, Mr. Macrosty, to whom they were greatly indebted. It might be that, looking back upon the past, one's mind might centre on some of the epoch-making names among the earlier Fellows, and it might be that in this generation there were no giants of a stature to be compared with those who figured so prominently in earlier years, but he did not believe for a moment—and he felt sure no one present would believe—that the general efficiency and average standard of qualifications of the Society had ever stood higher than they did to-day, and, after all, that was one of the chief aspects of this or any other Society. It was the general level of public interest and intelligence which was of the greatest importance, and it was in increasing and spreading that interest and intelligence, and in associating its work with the improvement of national well-being that the Society's true success should be recognized. The list of names to be balloted for as Members of Council and Honorary officers during the coming session, was sufficient evidence of the quantity

and the quality of talent which was at the service of the Society at the present time. He would particularly like to congratulate Sir Alfred Flux on the honour conferred upon him; and, next, he would ask the Fellows of the Society to elect as their President for the next two years one who had rendered, without ostentation, unequalled services to the Society, namely, Professor Greenwood, whose record was known to all and whose great distinction was a pride to all. He sincerely hoped that Fellows would follow the selection made by the Council, and honour themselves as well as Professor Greenwood by placing him in the Presidential Chair for the next two years. He had much pleasure in moving the adoption of the Report.

Mr. BRACE said he gladly seconded the proposal before the meeting to adopt the One Hundredth Annual Report and Statement of Accounts of the Society, for, personally, he was extremely indebted to the Society and desired to express his appreciation for the great amount of work done for the Society by the Council during the past year. The motion was then put to the Meeting and was carried unanimously.

The HONORARY SECRETARY announced that, in accordance with Bye Law 9, certain names would be removed from the roll of the Society as those of defaulters. These were: S. L. Agrawal, P. A. H. Bromwich, E. E. B. Eldridge, M. H. Gopal, W. E. Hill, M. H. Hoosain, S. S. Iyengar, A. MacCallum, S. C. Satyawadi, W. N. Srivasachari, J. P. Srivastava, G. F. Thompson.

SIR ALFRED FLUX said that before coming to the motion that he was to propose, he would like to express his personal thanks to the President for his reference to the honour which he felt he owed to his association with the Royal Statistical Society, and to the Fellows for their response to the President's remarks. He had carried responsibilities as an officer of the Society for a good many years, but he felt this to be a very great honour and responsibility. The purpose for which he had risen was to move the customary resolution which, he felt, should call forth on the present occasion a response even more hearty than that which was customarily given, namely, that the thanks of the Society be given to the President, Officers, and Council for the year 1933-34 for the work that they had done for the Society during that period. During the past year a specially onerous task had been imposed upon the Council owing to the entertainment of the Members of the International Statistical Institute in London as guests of the Society in connexion with the Centenary Celebrations. The *éclat* with which these celebrations were carried out reflected credit upon all those whose painstaking labours contributed to the

success of the meetings, and, if he possessed a more eloquent tongue, he would like to add a great deal to what had been said on that subject. He thought that the Centenary week did credit to the Society, and he felt that their guests must have gone away feeling that they had been entertained in a manner justifying the readiness with which they accepted the invitation to meet in London. He made his proposal with the greatest confidence, but at the same time with a certain regret, since it meant that they were parting with their present Chairman, as President. He hoped that Lord Meston, like his predecessors, would continue to take an interest in the work of the Society after he had ceased to occupy the Presidential Chair. During his occupation of that Chair, his colleagues had rejoiced to note the assiduity and pleasure with which he had entered into the Society's work. It was unnecessary to speak in detail of the other members of the Council. Two of the Honorary Secretaries would remain in office, and from them the Fellows had learned to expect great services. It was hoped that they were to be strengthened by the addition of Dr. Lsserlis, who would without any doubt live up to the pattern set him by his predecessors. It was, therefore, with great pleasure that he proposed that the best thanks of the meeting be given to the Chairman, Officers and Council for the year 1933-34.

Mrs. GEORGE said that it gave her very great pleasure, not only as having been Sir Alfred Flux's secretary for many years, but also as a Fellow of the Society and member of the Study Group, to second, most heartily, the vote of thanks to the Council and Officers.

The ballot for the President, Council, and Officers for the coming Session then took place, Mr. C. F. Rawson and Mr. Williamson being appointed scrutineers.

The CHAIRMAN thanked the Fellows of the Society for the appreciation they had shown of such services as he had been able to render during the past year, which were to himself a real pleasure. There was nothing much that could be added to what had already been said, but he would like to repeat how immensely he had enjoyed his period of office. Sir Alfred had not in any way exaggerated that pleasure; it was one which was frequently felt by a dweller in the outer courts when admitted into the glories of the inner temple.

THE HONORARY SECRETARY announced that the scrutineers, by signed report, certified that those named on the list put forward for ballot had been unanimously elected in their various offices. This concluded the business of the Annual Meeting, but before proceeding to the temporarily postponed Ordinary Meeting, he would like to inform the Fellows that the preparation of the list

of papers for the next Session was now being actively pursued, and several excellent papers had been promised by well-known Fellows of the Society. There were still some vacant dates, however, and if anyone was contemplating the offer of a paper, he would be glad to have notice of it at as early a date as possible.

It was announced that, as a result of the ballot taken during the meeting, the candidates named below were elected Fellows of the Society :

Robert William Brash.
Ivor Thomas William Cownie.
Stephen King-Hall.
Hubert William Hughes.

Robert Bernard Stiller.
Edward Butler Tanner.
Hugh Weeks.

The Meeting then adjourned for the Ordinary Meeting.

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REVIEWS OF STATISTICAL AND ECONOMIC BOOKS.

CONTENTS.

	PAGE		
1.— <i>Risser (R.)</i> . Applications de la Statistique à la Démographie et à la Biologie ...	658	5.— <i>Young (Terence)</i> . Becon-tree and Dagenham ...	665
2.— <i>Burns (A. F.)</i> . Production Trends in the U.S.A. since 1870 ...	660	6.— <i>Robbins (L.)</i> . The Great Depression ...	666
3.— <i>Schmidt (C. T.)</i> . German Business Cycles, 1924–1933 ...	661	7.— <i>Robinson (Joan)</i> . Economics of Imperfect Competition ...	671
4.— <i>Cahill (Sir Robert)</i> . Economic Conditions in France ...	662	8.— <i>Wernette (J. P.)</i> . Money, Business and Prices ...	674
		9.— <i>Meade (J. E.)</i> . The Rate of Interest in a Progressive State ...	675
		10.—Other New Publications ...	676

1.—*Applications de la statistique à la démographie et à la biologie*. Par R. Risser (Traité du calcul des probabilités et de ses applications, par Emile Borel—Tome III. Les applications de la théorie des probabilités aux sciences économiques et aux sciences biologiques. Fascicule III.) Paris: Gauthier-Villars. 1933. 10" × 6½". x + 255 pp. 50 fr.

This book is one of a series of sixteen dealing with the theory of probability and its applications, and discusses the use of statistics in the sciences of sociology and biology. The title embraces a wide field, but Prof. Risser has confined himself to certain aspects of the subject, which he deals with in self-contained Sections of his treatise.

The first Section deals with sickness and invalidity. Details are given as to the methods of collecting and analysing statistics from the records of Friendly Societies in order to produce rates of sickness at various ages, and an attempt is made to give an analytical representation of sickness of various durations by the use of "factors of reduction" which represent in respect of a particular age the ratio which sickness of any particular duration bears to the total sickness at all durations. These factors are derived from a differential equation similar to that from which the formula relating to Makeham's law of mortality can be derived. The result is that the form taken by the "factors of reduction" is very similar to the formula representing the numbers living under a life table which follows Makeham's law. The Section then proceeds to deal with the calculation of rates of entering upon invalidity from accident or sickness, deduced from the records of Assurance Companies. In taking into account probabilities representing rates of mortality of invalids and rates of recovery from invalidity, certain compound probabilities involving these functions are produced on lines which are familiar to actuaries.

The second Section deals with the construction of mortality tables

derived from statistics relating to the general population. After certain historical references to old methods, details are given of the present-day methods of producing a life table from a population census and returns of death in a period surrounding the date of the census. In particular reference is made to the construction of the table based on the French census of 24 March, 1901, and the deaths in in the years 1898-1903.

An attempt is then made to represent general population mortality by a formula, and details are given of the fitting of a Makeham curve to the French table mentioned above. A great deal of this Section of the book is taken up with detailed explanations of the methods of calculating the Makeham constants on lines which are familiar, particularly to actuarial students.

The third Section contains references to some interesting researches by M. Vito Volterra, dealing with biological relations and the struggle for existence. Volterra examines the problem from a theoretical standpoint, basing his investigations on the basic formula $dN = \epsilon N dt$, where N is the number of individuals and ϵ the coefficient of increase. He examines first of all the case of a single species living under conditions unaffected by outside influences. He then proceeds to examine the case of two co-existing species, (a) where the species both contend for the same source of nourishment, and (b) where one species preys upon the other. Proceeding on these lines he produces interesting formulæ relating to more complicated conditions in relation to larger numbers of co-existing species in which conditions (a) and (b) above operate as well as other outside influences.

Reference is also made to the researches of W. R. Thompson into the mathematical theory of the action of entomophagous parasites. Thompson remarks that the power of reproduction of injurious insects is such that if they were allowed to multiply freely for a very few generations, not a leaf or single blade of grass would be left on the earth. It is shown that Thompson's researches relate to a particular case of the general problem studied by Volterra.

The fourth Section deals with interpolation between and graduation of a series of discontinuous observations. The question is examined generally by assuming that the general term of a series may be represented by a rational integral function of the n th degree.

Approximate relations between the terms are then derived by limiting the expansion successively to the first, second and third degree.

In dealing with the question of graduation, reference is made to the method of "mechanical adjustment" by the use of what are generally called summation formulæ, and by the graphical method as expounded by Sprague. As regards summation formulæ, details are given of the construction of the formulæ bearing the names of Woolhouse, Karup, Higham and Achard. It should not be overlooked, however, that since these formulæ were first produced the rationale of the method of construction of summation formulæ in general has been fully expounded, with the result that nowadays more accurate and powerful formulæ are employed than those quoted

by the author : consequently the comparisons given of the graduating effect of the formulæ are mainly of historical interest.

It will be seen that the book as a whole is in the nature of a précis, and as such forms a useful introduction to the subjects dealt with in the various Sections, but for those interested in the subjects it would be necessary to refer to the longer expositions in the various works which are quoted.

O. C. J. K.

2.—*Production Trends in the U.S.A. since 1870.* By Arthur F. Burns. New York: National Bureau of Economic Research, 1934. 9" × 6". xxxii + 363 pp. \$3.50.

"The most important contribution to our knowledge of the increase in production which has been made since Mill wrote," is Prof. Wesley C. Mitchell's "commentator's summary" of the findings of this book. Many will doubtless consider this an exaggeration. But in the opinion of your reviewer, at any rate, who for some years past has been studying problems of long-term trend, such exaggeration is pardonable. The theoretical approach to the problem of booms and depressions is bankrupt. The events of the last few years, which have raised the problem of crises in a more acute form than ever, have also demonstrated that the purely deductive method, based on reasoning from certain fundamental assumptions with the aid of hypothesis, can never supply an explanation of crises.

Since its beginnings in 1920 the National Bureau of Economic Research has been engaged in the descriptive work of exploring the wide and intricate realm of social changes. Several volumes have been prepared on business cycles, one on the study of seasonal variations, and now comes the present study of secular trends by Dr. Burns. His work has been restricted to a study of the widely varying rates at which many American industries have grown from decade to decade since the 1870's, and seeking to ascertain the general features which have characterized this sample of increase in production.

Dr. Burns's conclusions may be briefly summarized. More than half of the "basic" industries have undergone a shrinkage in at least one of the eleven-year periods into which Dr. Burns subdivides his material. About half of the series show ranges of more than 11 per cent. between their slowest and their fastest rates of growth. Although inconstancy of rate has been a universal characteristic of industrial expansion in the United States, one element of order stands out boldly: that rates of growth tend to decline as the decades pass. To what is this due?

The gist of Dr. Burns's answer is that rapid growth in general production and decline in the rate of growth of individual industries go together. This latter is as characteristic of a progressive world as the former. The incessant introduction of new commodities restricts the increase in the demand for old commodities. The faster these new industries expand at first the greater is this restrictive influence, and the harder it is to sustain their own rates of growth for long. Doubling output each year may be feasible when a novel product wins favour. But a continuation of that rate of growth for

a generation or two would mean the marketing of impossible quantities. Changes in methods also lead to retardation. Industries which experience retardation are prone to organize in self-defence; in particular they resort to technical research and more intensive salesmanship. In so far as these efforts prosper they increase the pressure upon all other industries, limiting the expansion of the latter's markets and so strengthening the forces tending towards retardation.

There seems no warrant for the common notion that industries grow until they approximate some maximum size and then maintain a stationary position indefinitely.

Dr. Burns concludes his analysis of retardation by hazarding the suggestion that the life histories of industries are becoming shorter. A growing share of production is assuming the form of luxuries, superfluities and style goods; the demand for such products has not the same stability as the demand for staples. Both the retardation and trend cycles in individual industries indicate a transformation in the pattern of national production.

Dr. Burns has been unable to find in the existing samples of indices of production data sufficiently reliable to warrant a judgment on the rate of growth of production as a whole. All the long-range production indices now available are likely to understate the rate of growth in total production. He concludes that "if there has been any decline in the rate of growth in the total physical production of this country, its extent has probably been slight, and it is even mildly probable that the rate of growth may have been increasing somewhat."

It is impossible to summarize pioneer work of this kind in a short review, nor without a careful examination of Dr. Burns's original data to appreciate the value of his results and conclusions. But his book is well worth the attention of students of business fluctuations.

R. G.

3.—*German Business Cycles, 1924-1933.* By Carl T. Schmidt. New York: National Bureau of Economic Research, 1934. 9" × 6". xix. + 283 pp. \$2.50.

This study of cyclical fluctuations in German economy records the results of an investigation begun by Dr. Schmidt when a travelling Fellow of the University of California and completed when he was Research Associate at the National Bureau of Economic Research. It analyses the cyclical fluctuations during the period 1924-33, pointing out their special peculiarities and emphasizing the nature and relationships of the more significant contributory factors.

The author realizes that an analysis limited to one country over a period of relatively few years can add little to present theories relating to the *recurrence* of cycles in a money economy. But Dr. Schmidt believes that it is possible to make a contribution to the understanding of the nature of business cycles by sketching "the contours of the rhythm of a particular economy over a limited period, to direct attention to *unique* aspects of its cyclical behaviour." It may be doubted, however, whether, within the present extremely limited state of our knowledge of the causative factors at work in Business

Cycles, much is to be expected from a study of a disturbed period, subject to a variety of powerful influences arising out of structural changes in the working population, in the technique of industrial production, in business organization and in finance. The author, however, has rendered an important service to students by providing, within the confines of some 280 pages, a summary of the salient factors which have affected the German economy since the Treaty of Versailles and the currency inflation of 1921-23. The main contributions of the study are an application of the technique of statistical analysis of representative time series as developed at the National Bureau of Economic Research. The evidence presented supports the view that most aspects of German industrial production, prices and finance passed through two cycles during the period 1924-32; the first of these cycles was approximately delimited by the dates December, 1923, and March, 1926, while the second began approximately in April, 1926 and continued until the late summer of 1932—one of the longest German cycles on record. A knowledge of the events of the period, however, suggests that Dr. Schmidt is dealing with a combination—or confusion—of cycles, and it is not easy to attach very precise meaning to the statement that “enmeshed” in the fundamental modifications which were being undergone by the German economy was “a rhythm of cyclical fluctuations.” There is, moreover, little or no reference in the statistical analyses to the effect of structural changes on the trend of the time series. Students, however, should find much valuable material for further statistical analysis, especially when taken in association with that available elsewhere for a longer period.

R. G.

4.—*Economic Conditions in France*: Report (No. 581) to the Department of Overseas Trade by Sir Robert Cahill, C.M.G., Commercial Counsellor, H.M. Embassy, Paris. London: H.M. Stationery Office, 1934. 9 $\frac{3}{4}$ " \times 6". 722 pp., with map. 7s.

Sir Robert Cahill's last report on France was dated 1928, and the period of time which has elapsed between that date and that of the present report (June, 1934) makes the new issue of cardinal importance. As with all the author's work, this volume is comprehensive, clear, and impartial. The first chapter, on “certain basic features of the economic life of France,” deals with geographical distribution of activity, population, employment and wages, and cost of living, and the seven following chapters treat at length of agricultural production, of coal, minerals, oil, and electricity, of metal and engineering industries, of textile and chemical industries, of transport and communications, of external trade, and of state finances, banking, currency, and credit. Chapter IX gives a summary review of the economic situation, which the student would do well to read immediately after the first chapter before proceeding to the detailed examination of the several industries. Twenty-one appendices contain a selection of the more important statistics, and the volume ends with a sketch map showing the railways and chief towns; this map would be much more useful if the chief industrial and mining areas were indicated.

Out of a total population of 41,835,000 persons in 1931, about

21,394,000 were occupied—8,066,000 in agriculture, 6,681,000 in manufactures, 2,449,000 in commerce, banking, and entertainments (a curious combination!), and 1,031,000 in transport. The dominance of agriculture has important consequences on French economic policy. The period 1922–30, and notably 1928–30, was marked by “abounding prosperity,” arising in part from causes some of which may not be found in conjunction again; “to depreciation of the French currency in relation to those of principal customers such as the United Kingdom, the United States of America, Germany, and others; to the phenomenal inflation of credit facilities in North and South America and elsewhere; to consequential abnormal demand for the ‘luxury’ or semi-luxury goods, of which France is the chief purveyor, such as silk, laces, fine under and outer clothing, jewellery, perfumes, wines, spirits; to the efficiency both of the modern industrial equipment installed throughout French industry as a consequence of war devastation and of the modern French business spirit and organization for foreign trade; and, not least, to the immense fields of the invisible export trade from the inflow of nearly two million foreign visitors a year.” France to-day presents the paradox of a country very largely self-contained as regards satisfaction of essential needs, and yet very largely dependent on export trade. “In France, as in many other advanced industrial countries, there has developed since the war a complete disproportion between national production capacity and national consumption; it has probably been far more marked in France than elsewhere, owing to the immense reconstruction, sometimes of whole industries, after war destruction.”

The “economic blizzard” struck France a little later than other countries and was probably at its worst in 1932. The diminished purchasing power for luxury goods throughout the world and the “economic nationalism” which led distressed countries to adopt intensive measures of protection for industries threatened with ruin played havoc with French export trade. There has been some recovery from the worst—the general index of industrial activity (basis, 1913 = 100) had been 127 in 1928, had fallen to 96 in 1932, but recovered to 106 in the first quarter of 1934. But the end is not yet. Attention has been directed to the misleading “official” figures of unemployment in France. Sir Robert estimates the number of totally unemployed persons at 700,000 or 800,000; “some would put it at over a million.” Allowance must also be made for “deliberately organized” short time under which about two million employees were working in November, 1931. Further, during the boom years there was a tremendous influx of alien workers, of whom there were nearly 1,400,000 at the time of the 1926 census; in March, 1934, there were only 834,000, the places of those departed being taken by French nationals, and this replacement is still going on.

“France remains resolutely and indissolubly wedded to a strong and comprehensive protective policy for her agriculture and her industries. . . . The national policy is sustained with equal vigour by masters and workers in industry, and with even more pronounced and unanimous determination by the millions of peasant pro-

prietors. . . . Her tariff rates as a whole have moved persistently upwards since 1919." Those increases did not satisfy the industrial and agricultural classes, whose products were faced with the competition of the surplus products of many poverty-stricken nations, and in every way the French Governments have striven to free themselves from the restrictions imposed by commercial treaties. Finally, finding that no tariffs, however high, would dam the flood of imports, the quota system was introduced and now "no fewer than 3,000 out of 7,000 articles or classes of goods in the customs tariff" are "importable only in limited fixed quantities over short fixed periods under due licence." Similar policies being adopted in many other countries, "French producers tend to assume that, in the future, foreign markets for the ordinary commodities in general demand are likely to shrink substantially for the present industrial nations of Europe, and that reliance must mainly be placed on the home and colonial markets."

"The problem of the relatively high cost of living, which in its manifold repercussions has profoundly influenced the general internal situation and the export trade for the last three years, has become of quite supreme importance at the present juncture. . . . Producers already burdened with very heavy taxation and interest rates, and practically debarred from adjusting wages, . . . do not perceive any way of salvation except through a lowering of the cost of living." Among the causes of high internal prices are the gold standard, high taxation (*e.g.*, the turnover tax of 2 per cent. may become 12 or more on successive transfers by sale), "customs, excise, and analogous imposts, quotas, price-fixing either by public authority or by formal or tacit agreements covering substantial branches of industry"; there has also been a wide spread between wholesale or import prices and retail prices. Thus, last January the Parisian was paying 2*s.* 11*d.* per lb. for beef steak, 2*s.* 6*d.* per lb. for butter, and 9*s.* per ton for coal. The Government is trying to reduce costs "by a positive policy of deflation as regards both its own liabilities and prices generally." Reduction of government expenditure, lowering of taxation, cheapening of interest, and improvement of transport facilities, and definite reductions secured by the Government in the prices of coal and fertilisers (with electricity to follow) are measures of which the cumulative effect "is bound to be considerable." Another form of assistance to industry is the "State, public, or quasi-public provision of certain indispensable preliminaries or aids to productive activity," and much has been achieved in the improvement of roads, railways, and ports, but there are also extensive schemes for "national equipment," the latest or "Marquet Plan" having only been recently adopted. Such public works, it is hoped, will relieve the unemployed and, by increasing purchasing power, aid industry. Much has also been done to improve the general organization and technical efficiency of agriculture, and it is hardly necessary to remind readers that French industry has been completely renovated in the last twenty years. Simultaneously there has been a "persistent and prolific" movement towards consolidation of industry, while "mass production on a large scale and the formation of immense strictly

ordered schemes of concentration and rationalization " have been avoided as unsuitable to the specialized character of many branches of French industry. What we do find is that in many industries the bulk of the output is in the hands of a very few firms, and this applies not only to coal, iron ore, iron and steel, some branches of engineering, and various chemicals, but also to flour, sugar, glass, paper, tiles, plates, cement, tyres, films, cinemas, books, and leather footwear. "A notable feature in recent years has been the emergence of a lively " industry consciousness, " both in the national and the international spheres. In France and other continental countries, remarkable efforts have been made, first to adjust output to probable consumption within national frontiers and to establish standard price levels, and then to co-operate internationally for the limitation of global output, the fixation of prices and the partition of markets." With this significant quotation we may leave a report of which a score of different reviews could equally well be written. H. W. M.

5.—*Becontree and Dagenham: the Story of the Growth of a Housing Estate.* A report made for the Pilgrim Trust by Terence Young, B.A. With an introduction by the Right Hon. Stanley Baldwin. London: Published by the Becontree Social Survey Committee, 1934. 8 $\frac{1}{4}$ " \times 5 $\frac{3}{4}$ ". 420 pp. 10s. 6d.

While social surveys are being inaugurated and their results issued to us thick and fast, it is particularly fitting that attention should have been paid to an unprecedented social experiment—"the rehousing of more than a hundred thousand people by one local authority in one place." At the close of the nineteenth century the area of what is now the Becontree Estate was entirely devoted to market garden produce, contributing to the needs of the London market. In 1922 the population of the area was a little more than 9,000; within ten years it had increased by over a hundred thousand persons. Under the auspices of the Pilgrim Trust and a special survey committee (composed of Sir Wyndham Deedes, Captain L. F. Ellis, and Sir Edmund Phipps), a close study has been made by Mr. Young of every social aspect of this phenomenal growth.

In creating the Estate the London County Council's object was the creation of a new township, to accommodate when completed 125,000 to 130,000 people on an area of nearly 3,000 acres, for the relief of overcrowding of working-class people in the central area. How far this scheme has been achieved, the advantages and disadvantages that have attended it, and the development of the Estate in the future are the problems to which Mr. Young has ably devoted himself. The Council's "dream of a new township, complete in itself," has, he finds, not been realized, mainly because of the division of the area between three local authorities. The London County Council is the landlord, but it has no control over local government services. Dagenham Urban District Council is the local government authority for more than half, the eastern half, of the Estate; Barking Municipal Borough controls the western part, while a small section in the north-west falls under the ægis of Ilford Municipal Borough. The task of the Dagenham authorities

has been particularly difficult. The Estate comprises about 80 per cent. of its whole population, and its Council has had to start the whole of the public social services with which it was concerned practically from nothing, almost at the same time, and for a mass of uniformly small, low-rated property unrelieved by better-class houses or shops.

This uniformity of the population has hampered voluntary work as well. Eight out of every ten men were, in 1931, manual workers and there are absent from the district classes of people which would be found in any ordinary town, and from which churches in particular are likely to draw their workers—"middle-class men with more leisure than working-class men, and their wives with ample time for social work of various kinds." This factor has made it peculiarly difficult to secure the right people to act in such capacities as leaders of young persons' organizations, the need for which is shown in the grossly abnormal age distribution of the population—half the population was under 17 years of age in 1931, compared with a quarter in London. This preponderance of children, combined with the uneven growth of the different parts of the Estate, has also led to difficulties in the provision of educational facilities. In the earliest days for many infants for considerable periods there was no elementary school accommodation, and it was not until 1929 that serious school overcrowding was reduced, while frequent re-organization has been necessary.

As regards employment, there was practically no increase in new industries until the Estate had been in existence for ten years. The unemployment figures, however, have been favourable, partly because tenants, when they first move to Becontree, are, with few exceptions, in employment, while, secondly, there is a high rate of removals (in the first ten years over 30,000 people moved and were replaced by others), and amongst these there will be many unemployed persons who can no longer afford to live in the Estate houses.

Of these and many other problems Mr. Young gives a clearly-written and interesting account. When similar rehousing schemes are under consideration, his report must prove a most useful guide both to the advantages and disadvantages of the methods here adopted, as well as to the means of promoting the one and reducing the other. As Mr. Baldwin emphasizes, the provision of houses alone may not be enough. "To provide no halls or other buildings in which people can meet seems a serious mistake, whatever be the reason in law and policy."

A. B. H.

6.—*The Great Depression*. By Professor L. Robbins. London: Macmillan, 1934. 8½" × 6½". xvi + 238 pp. 8s. 6d.

Amid the divergences of view of present-day economists it is very desirable that each in turn should furnish a systematic exposition of his interpretation of contemporary events. In this book Professor Robbins presents what may be called the nineteenth-century view. The point of view from which his conclusions spring, he says in his preface, is not specifically his own, "but is the heritage of generations

of subtle and disinterested thought," and is "a point of view whose applicability to the interpretation of the bewildering problems with which we are now confronted has not been sufficiently recognized."

The ground is satisfactorily cleared by a well-written chapter on "Misconceptions." To suppose that "the fall of prices is the cause of the depression" is a misapprehension (p. 12). "Prices are the resultant of the forces underlying, on the one hand, commodity supply, and on the other, money demand" (p. 13).

On the side of supply, "so long as there remain anywhere wants which are unsatisfied, it is quite clear that there cannot be over-production in the sense of a real superfluity of commodities." The over-production that does exist means "that, in wide groups of important markets, at the price prevailing, the supply cannot be sold at a profit" (pp. 13-14).

"Technical progress . . . is essentially a cost-reducing process," and "there is nothing inimical to the profitability of particular undertakings if the prices of the things they produce fall *pari passu* with their cost" (p. 20).

It would seem to follow that, if business has become unremunerative, the cause is to be sought not on the side of commodity supply but on that of money demand.

If this is so, why, Professor Robbins asks, are the constructional industries and those producing raw materials more seriously affected than those producing consumers' goods (p. 31)?

He finds the explanation in the manner in which new money is made available by way of an expansion of credit through the banks. "The rate of discount of the Central Bank is the main regulator of money supply" (p. 36). When he comes to explain this in detail, he regards the rate of discount (supported if need be by open-market operations) as operating exclusively through the long-term rate of interest and the investment market. If the rate moves downwards, "the effect will at first be confined to the short-loan market. Bill rates and call-loan rates will be low" (p. 40). But the short-loan market he identifies with "the inner circle of financial institutions," as if there were never any short-term lending to traders in commodities to provide working capital. He regards a monetary expansion as taking effect, in the first instance, exclusively in a demand for capital-goods.

The result is to give a *very* distorted picture of the operation of the discount rate, and one as much out of harmony with the conditions and doctrines of the nineteenth century as with those of the twentieth. But the general principle that the money supply is regulated by the discount rate remains unaffected.

The sums of new money which come from the banks, as they filter through the economic system, gradually become ultimate income. "There is nothing which justifies us in assuming that the recipients of income will necessarily increase the proportion of their incomes that they save. It follows, therefore, that as the new money becomes income we must expect a strengthening of the demand, not for capital-goods, but for income-goods. The old proportion between demand for income-goods and demand for capital-goods tends to be re-estab-

lished" (p. 38). Not an altogether satisfactory explanation of why the old proportion is *changed*.

It is quite true that the new money becomes income and that the distribution of the new demand depends on how the new incomes are spent. But it is as true of an expansion as of a contraction that "the first impact of the shock falls upon profits" (p. 187). Profits are the principal source of savings, and so long as profits are above normal the demand for capital-goods will be correspondingly stimulated. So long as that is so, the old proportion will *not* be re-established.

Professor Robbins describes the vicious circle of credit expansion (pp. 40-2), and he offers a theory of how it is broken and a depression ensues. When the demand for consumption-goods expands, "the producers making for immediate consumption will now be in a stronger position to bid against the producers of capital-goods for the factors of production which they use in common, and for new loans from the banks. And what does this mean? A tendency to a rise in costs and a hardening of market rates of interest. Wages rise. Interest rates in the short-loan market rise still more" (p. 39).

"The technical strain on the credit structure becomes greater and greater. At the same time the rise in wage rates, reinforced probably by the expenditure of speculative gains for consumption purposes, diminishes the prospects of profitability of the industries producing capital-goods, both by raising their costs and by . . . raising the rate at which they can borrow. . . .

"Once costs have begun to rise, it would require a continuous increase in the rate of increase of credit to prevent the thing coming to disaster. But that itself, as we have seen in the great post-war inflations, would eventually generate panic" (pp. 41-2).

It is very strange doctrine that it is by the prosperity of the consumption industries that the activity of the instrumental industries is interrupted. For it is the consumption industries that furnish the demand for the products of the instrumental industries, and it is the high profits anticipated by the former that cause the activity of the latter, and bring about capital outlay to use up the swollen savings of a time of high profits.

The activity of industry, whether producing consumption-goods or capital-goods, does tend to induce a rise of costs. But why should the rise of costs ever *overtake* the rise of prices? Professor Robbins offers no reason why it should, and no evidence that it does. In the post-war inflations, to the experience of which he appeals, the lag of wages behind prices continued to the bitter end. Money wages were extremely low both in Germany in 1924 and in France in 1926.

He quotes the index of American wages as having risen from 212 in January, 1925, to 227 in September, 1929. The index is not very reliable, but he suggests that the true increase of costs was greater than the increase in wages. "During the later phases of a cycle costs rise faster than the movement of wage rates would suggest" (p. 47). Does he mean that owing to the rise in costs American industry had become unprofitable at the price level of 1929? On the next page he argues that inflation prevailed, and that this was not inconsistent

with the apparently low price level, because "when productivity is increasing, then, in the absence of inflation, we should expect prices to fall. Now the period we are examining was a period of rapidly increasing productivity."

The increase in the national income was very moderate, but that, we are told, under-estimates the increase in consumption because "speculative gains were treated as income and spent accordingly." Surely this is a very flimsy argument. If demand is reinforced by "speculative gains," the additional demand quickly generates additional income. The national income cannot lag far behind increasing demand.

But in any case what is the use of trying to show that there was inflation in 1929, in the sense that prices were excessive relatively to costs, when the explanation given of how the period of prosperity was brought to an end is that costs became excessive relatively to prices?

It is not certain that costs are increased at a time of activity. The relative inefficiency of labour when fully employed may well be more than compensated by the greater efficiency of plant when employed more nearly to capacity. But if costs are so increased, surely the desirable price level is that which will enable labour and capital to be fully employed in spite of the relative inefficiency of the former.

The increase in costs, it may be said, is not only in wages, but in the short-term rate of interest. But that is in the hands of the banks; it is indeed the instrument to which the central bank resorts to expand or contract the flow of money.

When Professor Robbins says there was inflation, what he is seeking to show is that demand and prices had reached a level *at which they could not stay*. He need not have troubled to consider whether prices were or were not too high relatively to costs or whether wages had risen. The expansion was brought to an end by "the technical strain on the credit structure."

What is this technical strain? He can only mean the gold standard. If there is no limit on the creation of currency, there need be no technical strain, though the price level rise tenfold or ten thousandfold or a billionfold.

And undoubtedly the limitations imposed by the gold standard were operative in 1929. It is true that apprehensions arising out of the Wall Street speculation were the principal ground for the credit restriction in the United States in 1928 and 1929. But even if gold did not set the limit there, it did in England.

Professor Robbins is satisfied that there was no sterilization of gold in France because the note issue increased as fast as the gold and foreign assets of the Bank of France (p. 26). But he never mentions how much of this reserve (approaching and sometimes exceeding 100 per cent.) was metallic gold, and he disregards altogether the sudden replacement of seven milliards of foreign assets by gold in the opening months of 1929. The absorption of £250,000,000 of gold by France in the period from 1927 to May, 1931, is completely ignored.

Professor Robbins roundly condemns the relaxation of credit by the Federal Reserve Banks in 1927. Yet it was a time when they

were overburdened with redundant gold and when, as he says (p. 52), "a moderate depression was in sight." The result was, he says, that the situation "got completely out of control." In what sense was it out of control? No one indeed was in a position to "control" the speculation on the Stock Exchange. But industry responded to the credit restriction that was imposed in the middle of 1928. The turning-point did not come till June, 1929, but, when measures of credit restriction are imposed at a time of great activity, an interval of twelve months or so before they take visible effect is entirely in accordance with experience.

The recession in industry was followed four months later by the Wall Street crisis. It was after that that the situation was allowed to get "out of control," but in a very different sense. Professor Robbins devotes a chapter to explaining why "the deflationary process . . . has been one of unparalleled severity" (p. 55). Political unrest, excessive indebtedness, the growth of cartels and schemes for the restriction of supply, fraudulent finance, excessive tariffs, the rigidity of wages, the practice of supporting insolvent concerns, all these are included in the explanation. Most or all of these may be undesirable, but that does not necessarily mean that their effects are deflationary. Some of them might equally well be inflationary, and some were even so regarded at the time when inflation was raging. The rigidity of wages and schemes for the restriction of supply aggravate the distresses due to deflation, but they do not intensify the deflation itself. Tariffs mitigate deflation in the countries which adopt them or increase them, at the cost of intensifying it elsewhere.

Economic planning is Professor Robbins's black beast. Restriction, Monopoly and Tariffs are its horrid offspring. Supposing as he does that money has to be created through outlay on fixed capital, he has no difficulty in finding some tendency towards a restriction of capital outlay somewhere in each of the deflationary causes he adduces. In reality it is quite superfluous to look for extraneous causes of this kind. He has described the vicious circle of inflation, the repercussions which tend to exaggerate any inflationary movement once it has begun. But he has neglected to mention the corresponding case of the vicious circle of deflation, whose deadly repercussions may induce such a state of stagnation and despair as may make business impervious for the time being to any measures of credit relaxation. The vicious circle once joined, any degree of depression becomes possible. In the century before 1914 revival would come when depression reduced the monetary circulation, and redundant gold led through cheap money to expansion. In 1930 and 1931 there was no redundant gold. Professor Robbins says that "the moment the boom broke in 1929 the central banks of the world, acting obviously in concert, set to work to create a condition of easy money, quite out of relation to the general conditions of the money markets" (p. 73). But in fact the transition to easy money was extremely slow, in marked contrast to the rapid transition that had been made after any of the crises between 1870 and 1914. By the time it was completed it was too late. The vicious circle of deflation had developed into a complete deadlock. It is that deadlock which has interfered with

the normal operation of measures of cheap money and open market purchases, which might have been expected to induce revival. Professor Robbins takes no account of it.

In his chapter on conditions of recovery Professor Robbins gives the first place to the restoration of fixed parities in the foreign exchanges, and that means fixed parities for all the important currencies in terms of gold. "No one will deny," he says, "that the presence of unusual risks in the shape of exchange fluctuations, apprehensions of political disturbances and the like, has held up spending to a degree which has been highly deflationary" (p. 162). At any time between March, 1919, and 1924 he could have gained equally ready assent to the highly *inflationary* effects of exchange fluctuations and political apprehensions. Exchange fluctuations are undoubtedly undesirable, but so long as they are of an order of magnitude no greater than price fluctuations they introduce little additional risk into international trade. So long as exchange restrictions and import restrictions continue among the gold standard countries, stable exchanges can do very little to revive international trade. And the restrictions cannot be removed until either the world price level rises in terms of gold, or the gold countries abandon their attempt to adhere to old parities.

For a future policy Professor Robbins is inclined to accept a gold standard with international co-operation directed to the stabilization of *incomes*, a price level falling with increased productivity (p. 171). This is perhaps the closest approach we can make to a perfect currency system. He wisely holds that the price level alone may not give sufficiently prompt warning when action has to be taken. When, however, he suggests reliance on the prices of stocks and shares, this is not an altogether satisfactory solution. Stocks and shares would often give wrong guidance. In fact they reflect nothing more infallible than the united wisdom of the operators in the stock market. The central bank ought to have at least as good data in its hands as they, and ought to be able to see further. There has seldom been so great a rise as in the New York market from November, 1929, to April, 1930, but this was far from presaging a boom!

R. G. H.

7.—*The Economics of Imperfect Competition.* By Joan Robinson. London: Macmillan, 1933. 9" x 6". xii + 352 pp. 18s.

This book takes a step forward in economic theory. Mrs. Robinson makes handsome acknowledgments in her preface to other economists who have been at work on similar ideas, and her own contribution is so considerable that she can well afford to give recognition to others.

The starting point of this new departure in theory is the deposition of the hypothesis of "perfect competition" from its dominant place in the analysis of supply and demand. Economists have usually treated perfect competition as the rule and perfect monopoly as the principal exception, without taking very much account of intermediate cases. But, in practice, these intermediate cases are the rule, and perfect competition is a limiting abstraction.

Under perfect competition the market price, being the resultant

of the action of an indefinitely large number of individual buyers and sellers, is imposed on any one seller by the others; nothing that he does can materially alter the price. "Any one producer will be able to sell as much as he pleases at the current market price. If he lowers his price, by however little, he will be able to capture the whole market, while if he raises his price, by however little, he will be unable to sell at all" (p. 51).

Those conditions being postulated, the output of any product will be such that the marginal cost is equal to the market price. If c is the cost of an output, x , then $\frac{dc}{dx} = p$.

In the case of a monopolist, on the other hand, price is not extraneously determined by an indefinite number of competitors, but is a variable, dependent on the amount the monopolist himself offers for sale. Marginal cost is equated no longer to a constant market price, but to what Mrs. Robinson calls "marginal revenue," the gain in total receipts from a given increment of the amount sold. If s be the proceeds of sale, $s = px$, where p is a variable, and equilibrium is reached when $\frac{dc}{dx} = \frac{ds}{dx}$, that is to say, when $s = c$, the excess of proceeds of sale over costs, is a maximum.

Now the condition that market price is, from the point of view of the individual producer, constant is peculiar to the case of perfect competition. The intermediate cases of imperfect competition resemble that of monopoly in that price is in some degree dependent on the individual producer's own action. His price need not be identical with his competitors' prices, and, if it differs from them, the consequent gain or loss of business will not be unlimited. That is so for a variety of reasons. Not only may there be advantages of locality, but one firm's product is not in general indistinguishable from another's. And along with preferences based on real differences of pattern or quality, there are likely to be others depending on mere "goodwill," associated with habits or personal relations.

For any producer who has the power of varying the price of his product at all independently of his competitors' prices, Mrs. Robinson shows that the same analysis is appropriate as for monopoly. That is to say, marginal cost, $\frac{dc}{dx}$, must be equated not to a constant market price, p , but to marginal revenue, $\frac{ds}{dx}$.

If the traditional analysis based on perfect competition is to be supplanted by this new analysis on the model of monopoly, a considerable section of economic theory requires to be restated. And it has been Mrs. Robinson's task to deal with a part of this field of operations.

She is well equipped for the undertaking with a clear and attractive literary style, and also a remarkable command of the method of geometrical representation of economic variables. She declares herself to be "almost entirely innocent of mathematics," and the mathematical proofs provided "were always required to give pre-

cision to some conclusion of which the general drift was discovered by unsophisticated methods." Much mathematical reasoning, sometimes of a subtle character, has been presented through the medium of her geometrical diagrams in a form which can be grasped by the non-mathematical reader. Possibly it would have been of advantage if footnotes or appendices had been added giving the algebraical counterparts of the curves, but any industrious reader who needs an algebraical exposition may find a useful exercise in supplying it himself.

Imperfect competition allows a monopoly profit equal to the excess of the proceeds of sale over cost, or $s - c$ (p. 56). Normal profit is equal to the "transfer value" of the entrepreneur, the income that he might earn in another occupation. Any excess of his actual profit over this transfer value is the entrepreneur's "rent" (p. 110). The same definition of rent is applied to other factors of production. Has not Mrs. Robinson here put a strain on language in her pursuit of symmetry? To call the excess of the earnings of labour over its earning power in any other occupation a "rent" is quite legitimate. But to exclude from rent so much of the value of land as represents what it could earn in its second best employment (pp. 105-7) is a flagrant departure from usage. Nor is anything gained by trying to force profit into the same mould. The transfer value of an entrepreneur is a very indeterminate quantity. "For long-period problems the entrepreneur is conceived to require a certain reward, sufficient to induce him to continue in business, which is independent of the amount of his output" (p. 17). Thus the reward of the entrepreneur is "always a fixed element in total cost" (p. 49). These passages seem to imply a transfer value equal to what the entrepreneur could get by way of salary and interest on his capital if he were not an entrepreneur at all.

But in practice the income of the entrepreneur, being the margin between selling value and costs, is approximately in proportion to turnover (subject, of course, to the variations in average costs). His transfer value from entrepreneurship in another industry, therefore, would not be a fixed minimum income, but would be dependent upon his probable turnover in that industry.

The entrepreneur's rent becomes a very phantom-like quantity, and itself becomes dependent on turnover.

Mrs. Robinson is a little uncertain as to whether the rent of the entrepreneur is to be included in costs. She decides on p. 125 to include it, but on p. 150, in the case of a monopoly, "the rent of entrepreneurship must clearly not be regarded as part of the expenses of production, but as part of the monopoly profit."

In practice what has to be allowed for is the profit margin calculated by the entrepreneur from any additional output. There will probably be a prevailing rate of profit in the community (to be modified perhaps in the circumstances of different industries), and in general an entrepreneur will refuse to extend his output beyond what is consistent with that rate of profit. In other words, a normal rate of profit on turnover is treated as part of the marginal cost. Marginal revenue will not be reduced below the level which will

allow this excess over other constituents of cost. So long as all his competitors are aiming at normal profits, the entrepreneur can do the same without exploiting the possibilities of imperfect competition.

The income derived by an entrepreneur from profit depends on the magnitude of his business. Mrs. Robinson's analysis would make the capacity of a concern conform to its theoretically appropriate output, that which makes marginal cost equal to marginal revenue.

In practice the magnitude of a business is limited by the entrepreneur's capital together with the capital he can raise in the market. Mrs. Robinson has deliberately abstracted from the passage of time, and it may be contended that *in time* the capital resources of any concern will expand to whatever extent is appropriate to its selling power or goodwill.

Perhaps Mrs. Robinson might usefully have said a little more about the varying degrees of imperfection in competition. Even if perfect competition in its most rigorous sense is an abstraction, yet it often happens that the degree of freedom to be exercised by any one seller in varying his price without relation to the prices of his competitors is very narrow. In such a case he may well aim rather at fixing a competitive price as exactly as he can, than at extending his sales by lowering his price or exploiting his goodwill by raising it. Mrs. Robinson simplifies her analysis by treating all expenditure on advertising "as equivalent, from the point of view of the entrepreneur, to a reduction of price having the same effect upon sales" (p. 21). And no doubt she would apply the same treatment to any other expenditure on extending goodwill. But to express goodwill at all in terms of a curve relating demand to price is not altogether satisfactory. The more practical aspect of goodwill is usually the volume of sales that can be effected at a competitive price, which is almost as definitely "given" as under perfect competition. In a static analysis leading up to an equilibrium arrived at after protracted processes (such as the accumulation of sufficient capital to exploit the goodwill of the progressive concern) it is doubtful how much scope ought to be allowed to so transitory a device as charging more or less than a competitive price.

R. G. H.

8. *Money, Business and Prices*. By J. P. Wernette, Ph.D. London: P. S. King, 1933. 7½" × 5". vi + 104 pp. 5s.

The author's excuse for "adding yet one more book to the already voluminous literature of Depression" is that "much diagnosis by many persons may bring us one day to prognosis and cure." It speaks well for the patient's constitution that, in spite of all the consultations which have taken place, and in spite of all the prescriptions which have been offered, he still lives. The reason probably lies in the fact that few of his nurses have the courage to insist on the medicine being taken.

Dr. Wernette holds that a depression is not inevitable and not, as many people contend, a result of and a cure for the excesses of a previous boom. He refuses to admit that the 1929 level of prosperity

in the United States was "artificial," "unsound," or "fictitious." Unfortunately, he does not define what he means by "level of prosperity." It would be extremely difficult to defend the superstructure, based to a very large extent on paper gains in Wall Street, from such charges. Although we may not be inclined to agree with the doctor's opinion of his patient's general state of health immediately prior to his illness, it does not follow, however, that he may not be able to give some useful suggestions for treatment.

The first half of the book is devoted to a discussion of money and monetary processes. The author then discusses various causes of changes in spending before passing on to the "detection" and "deflection" of cyclical fluctuations.

The book was actually written before the United States went off the gold standard, but the author adds a footnote written after that event, pointing out that he has left unchanged his attack on the gold standard worshippers. Monetary stability being the *end* desired, "why not operate the monetary system," he says, "by aiming directly at the *end*, instead of aiming at the *means* to the end?"

Dr. Wernette's verdict is that the patient is in a desperate condition and requires a desperate remedy, and his prescription is labelled "inflation," but he omits to define the dose required.

G. R. W.

9.—*The Rate of Interest in a Progressive State.* By J. E. Meade. London: Macmillan, 1933. $8\frac{3}{4}'' \times 5\frac{1}{2}''$. x + 115 pp. 7s. 6d.

One of the greatest obstacles confronting the student of economics at the present time is the lack of a uniform terminology. Some, even of the most common, words in the economists' vocabulary—money, savings, investment, inflation, and so on—are capable of a bewildering variety of definitions, each giving a slightly different shade of meaning. It is dangerous to approach any new author on economic theory without first discovering what terminology he is employing. It is as though the student of chemistry had to consider the possibility of different authors of chemistry text-books attaching different meanings to the words chlorine, hydrolysis, or catalytic action, or as though no two mathematicians gave the same definition of parallelogram, π , or $\sqrt{-1}$. The need for standardization has long been recognized in other branches of science, and steps taken to meet the need. The British Standards Institute has rendered and is rendering invaluable service to engineering by reducing chaos to order with its standard specifications. In an entirely different sphere, the League of Nations is attempting to introduce a uniform customs nomenclature so that people in different countries may speak the same fiscal language. Sooner or later economists will have to tackle the problem of a standard specification for the tools of their trade or a uniform economic nomenclature.

These thoughts spring to the reader's mind on first delving into a book which, according to the author, is "of a purely introductory nature." The first chapter of Mr. Meade's work is devoted to "assumptions and definitions." There are probably less than a dozen actual definitions, but each of these is linked up with one or

more of its fellows and with other terms by means of more than a score of equations. Having mastered the author's interpretation of a Progressive Society, Final Incomes, Net Investment, Savings, Budget Deficit, etc., the reader is allowed to advance through two more chapters before being pulled up by the necessity to master another batch of definitions and equations. The mathematically minded reader is tempted to associate a symbol with each of Mr. Meade's definitions and to express his equations in symbolical form. This would serve the dual purpose of facilitating recognition of the many terms as they appear, and would reduce the four or five lines of print which are often required for one equation to a single-line formula. Before doing so, it is well to warn the reader that later in the book Mr. Meade makes use of practically every letter in the English alphabet (small and capital) and most of the Greek alphabet for another purpose.

The avowed object of the book is "to discuss the effects of changes in the economic situation in a progressive society upon the equilibrium rate of interest." The author does this by discussing three questions: (1), what can be meant by an equilibrium rate of interest? (2) what changes in this equilibrium rate are to be expected in a progressive society? and, (3) in what conditions will the market rate of interest move so as to conform with the equilibrium rate? He is very careful to point out that he does not make any practical proposals and that the work is merely introductory to the discussion of the economic consequences which will follow a discrepancy between the actual market rate of interest and the equilibrium rate.

G. R. W.

10.—Other New Publications.

Ashworth (Robert). The Structure of Business Management. London: Gee, 1934. $8\frac{1}{4}'' \times 5\frac{1}{2}''$. 48 pp. 3s.

[The text of a lecture which was delivered to the Office Management Association in April last, with the object of directing "attention to the great national waste at present resulting from mismanagement, which is largely contributed to by the lack of national co-ordination and control of industrial and commercial effort." The problem, the author tells us, is "of vital national importance," made so by "keen international competition, bringing in its train restrictive tariffs, uneconomic production, and price-cutting." After a definition of the word management, and a short account of the effect of inefficient management, the author sets out what he considers to be the fundamental principles essential to efficiency. The management of Limited Liability Companies is given special consideration. The author concludes with a short discussion of the future of management and its effective control from a national point of view.]

Buchanan (Sir George), C.B., M.D., F.R.C.P. The Milroy Lectures on International Co-operation in Public Health: Its Achievements and Prospects. Delivered before the Royal College of Physicians of London on Feb. 27th and March 1st, 1934. Reprinted from the *Lancet*, April 28th, May 5th and 12th, 1934. $8\frac{1}{2}'' \times 5\frac{1}{2}''$. 60 pp.

[The official status of public health was raised during the war period by the establishment of Ministries of Health in many countries where none had

previously existed; and the institution of the League of Nations in 1918 made possible international co-operation in health matters. "What has been accomplished . . . since the war, both at Paris and Geneva, and what encouragement we have to do more work on the same lines in future" is the main consideration of these lectures. In the first, after discussing the organization and work of the Rockefeller Foundation and of the Red Cross and League of Red Cross Societies, the author surveys the part played by the League of Nations in health matters and gives instances in which, on the one hand, it has rendered services to medicine, and, on the other, has found the use of medical and public health knowledge an advantage in promoting international fellowship. The second lecture is concerned with cancer studies, the general work of the League's Health Organization and of the Office International d'Hygiène Publique, and gives a brief review of the work of the International Sanitary Conventions of 1926 and 1933 and other international health conventions. The last section deals especially with British participation in international health organizations.]

A Bibliography of Differential Fertility. In English, French, and German. Edited by Eldon Moore on behalf of Commission II of the International Union for the Scientific Investigation of Population Problems. Edinburgh, 1933. 6" \times 9 $\frac{3}{4}$ ". vi + 97 pp. 2s.

[This Bibliography was undertaken as a sequel to the work done by the Commission mentioned in the title, which was appointed to investigate questions of Differential Fertility, Fecundity, and Sterility. Professor F. A. E. Crew, the Chairman of the Commission, contributes a brief foreword. The book contains over 1,100 entries, 700 of English and 200 each of French and German works, the division being, of course, linguistic and not national. The arrangement is chronological and on inspection justifies the editor's choice of this as the most reasonable and useful method of classification. Each page is divided vertically so that the languages are shown in separate columns, and the later books in English are further subdivided into "animal" and "human." This has necessitated a wide page and resulted in an oblong volume, not very convenient for the average shelf. Otherwise the book is very well produced. The types are well chosen and the entries well set out. The works published in any one year are given in alphabetical order of the authors' names, and there is an alphabetical index of authors. Letters are appended to the English references to indicate the London libraries possessing the works. Each page is headed by a date or dates covering the entries, the first heading being 1798-1847 and the last 1930-1931. An appendix gives a list of regular official publications of a relevant nature, in English, French, and German. The publication has been subsidized by the International Population Union, hence the very modest price.]

Johns Hopkins University. School of Hygiene and Public Health. Collected Papers, Vol. XIV. 1932-1933. Baltimore, June, 1933. 9 $\frac{3}{4}$ " \times 6 $\frac{1}{2}$ ".

[The papers in these annual volumes are by the staff and students of the School and are reprinted from various periodicals (the *American Journal of Hygiene*, *Human Biology*, *Journal of the American Medical Association*, the *American Journals of Chemistry and Physiology*, *Public Health*, etc.). The present collection, numbering 85 in all, includes a few which are of definitely statistical interest. We may mention (XVII) Contraception and fertility in 2,000 women and (XVIII) Some data on fertility and economic status, by Professor R. Pearl; (XXXIII) Time changes in the number of gainfully employed men and women in the United States in relation to population growth, by Professor Lowell J. Read; (XXXIV to XXXVI) Biometric studies in United States Army Officers, by Lowell J. Read and Albert G. Love; (XXXVII) Monthly estimates of

the child population susceptible to measles, 1900-1931, Baltimore, Maryland, by A. W. Hedrich. A group of papers embodies the results of statistical investigations into the incidence of the common cold in relation to various factors which have been suggested as having an influence on the susceptibility of the individual or on the frequency or severity of attack.]

Milward (G. E.). Business Man's Guide to Management, 1934. London: Management Library, 1934. $9\frac{1}{4}'' \times 6''$. 52 pp. 2s.

[The Management Library collects most publications of interest to the business world and issues short reviews each month of the books received. This publication condenses the reviews issued during 1932 and 1933, and these notes form concise annotations to the books and articles indexed. The entries are arranged by subjects grouped into six main classes: "General Management," "Production," "Distribution," "Company Secretary" (which includes Cost accounting, Budgetary control, Statistics, Insurance, Investment, and Office management), "Psychology," and "Industrial Economics."]

Peters (Harold Edwin). The Foreign Debt of the Argentine Republic. Johns Hopkins University Studies in Historical and Political Science. Extra volumes. New Series No. 21. Baltimore: Johns Hopkins Press. London: H. Milford, 1934. $8\frac{1}{4}'' \times 5\frac{1}{2}''$. 186 pp. \$2.

[The author states that his purpose is "to examine the export of capital as related to the finances of the Argentine Republic," and, believing "that historical perspective must modify an estimate of the present situation," he has begun his account with the revolution of 1810 and the subsequent inauguration of free exchange. The first two chapters give a summary history of the foreign debt in the periods 1824-80 and 1880-1914 respectively; the third traces the financial history of the Argentine during the war period, the fourth covers the years 1921-28, and the fifth deals with the crisis in Argentina. In the early portion the treatment is very brief and the subdivision into headed sections, dealing with different aspects of the matters treated, seems to break up the narrative in a rather irritating manner. The subsequent chapters, however, are much more detailed and continuous; they include various statistical tables and charts, generally taken from official publications. References are given throughout, a complete bibliography of sources is appended, and there is a really good index. Altogether a useful summary.]

CURRENT NOTES.

On p. 680 we give our usual table summarizing the overseas trade of the United Kingdom for the years ended July, 1933 and 1934. The trade returns for July are encouraging, exports of United Kingdom goods amounting to £33,230,000, a higher total than that recorded for any month during the past three years with the exception of April, 1932, and October and November, 1933. Seeing that there were five Sundays in July, such a result was hardly to be expected. The increase as compared with June was £1,110,000, and as compared with July, 1933, £3,283,000. For the first seven months of the year exports were £17,821,000 more than a year earlier.

Imports also increased, by £4,311,000, compared with July 1933, and, with a small decline in re-exports, the excess of imports over exports of merchandise increased from £19,444,000 to £20,667,000. For the seven months the excess increased from £139·1 million to £163·7 million. In view of the uncertainties in the present position as regards international trade and the probable movement of prices during the remainder of the year, any estimate as to what the adverse balance for the year may be must necessarily be very tentative. During the twelve months ended July the adverse balance amounted to £284 million as compared with £259 million in the calendar year 1933. Some further increase in this may occur, but it is unlikely that the total for the year 1933 will exceed £300 million and it may perhaps not be as high as the figure for the twelve months ended July.

Retained imports of food, drink and tobacco during July were valued at £25,431,000, or £65,000 more than a year earlier. The smallness of this increase is in striking contrast to the very large increases recorded for raw materials (£2,089,000) and manufactured articles (£2,570,000). An increase in value was recorded for meat, due very largely to a substantial increase in the average value of the imports of bacon and of mutton and lamb, the latter being the highest recorded since the end of 1930. In both these cases, there was a considerable decline in the quantity imported. Imports of beef showed a small increase in both quantity and value. The quantity of wheat imported, in contrast to earlier months this year, was larger than in July, 1933, and there was also an increase in respect of wheat flour, but other principal descriptions of grain were imported in smaller quantities. Among other foods, imports

Movements and Classes.	Twelve Months ended 31st July, 1923.	Twelve Months ended 31st July, 1931.	Increase (+) or Decrease (-).			
Imports, c.i.f.—	£'000.	£'000.	£'000.			
Food, drink and tobacco	348,668	344,065	(-) 4,603			
Raw materials and articles mainly un- manufactured	162,868	206,860	(+) 43,992			
Articles wholly or mainly manufac- tured	147,536	167,086	(+) 19,550			
Other articles	3,708	3,903	(+) 195			
Total Imports ...	662,780	721,914	(+) 59,134			
Exports, f.o.b.—						
<i>United Kingdom Produce and Manufactures—</i>						
Food, drink and tobacco	28,658	29,643	(+) 985			
Raw materials and articles mainly un- manufactured	44,269	47,989	(+) 3,720			
Articles wholly or mainly manufac- tured	268,408	295,109	(+) 26,701			
Other articles	12,591	12,503	(-) 88			
<i>Imported Merchandise—</i>						
Food, drink and tobacco	12,195	13,289	(+) 1,094			
Raw materials and articles mainly un- manufactured	24,387	28,247	(+) 3,860			
Articles wholly or mainly manufac- tured	11,084	10,902	(-) 182			
Other articles	231	265	(+) 34			
Total Exports ...	401,823	437,947	(+) 36,124			
Bullion and Specie—						
Imports	210,849	321,961	(+) 111,112			
Exports	106,583	128,827	(+) 22,244			
Movements of Shipping in the Foreign Trade—	Number of Vessels.	Thousand Net Tons.	Number of Vessels.	Thousand Net Tons.	Number of Vessels.	Thousand Net Tons.
<i>Entered with cargoes—</i>						
British	23,522	34,977	24,148	36,039	(+) 626	(+) 1,062
Foreign	22,632	24,171	25,037	26,259	(+) 2,405	(+) 2,088
Total entered ...	46,154	59,148	49,185	62,298	(+) 3,031	(+) 3,150
<i>Cleared with cargoes—</i>						
British	29,390	33,663	28,847	33,895	(-) 543	(+) 232
Foreign	19,439	21,203	20,958	22,090	(+) 1,519	(+) 887
Total cleared ...	48,829	54,866	49,805	55,985	(+) 976	(+) 1,119

of sugar were about the same as in July, 1933, eggs declined, but there were substantial increases in respect of butter, cheese and tea. There was a marked reduction in imports of unmanufactured tobacco; for the seven months imports increased, but a striking increase in re-exports to the Irish Free State resulted in a decrease of 5 per cent. in retained imports. The total quantity of duty-paid tobacco retained for home consumption in the first half of this year was, however, 7 per cent. greater than a year earlier.

Among raw materials, the only groups to show a decline in the value of retained imports in July compared with a year earlier were the four textile groups, and coal, imports of which are always negligible. Cotton declined by £984,000, wool by £266,000, silk by £6,000 and other textile materials by £100,000. The largest increases were recorded for wood and timber (£1,877,000), over half the increase coming from Russia, and for rubber, the imports increasing by £839,000 and the re-exports by £204,000, mainly due to the larger quantity taken by that country. Part of the increase in respect of rubber was due to enhanced prices, but the quantity imported increased three-fold and the increase in re-exports was nearly as great. Among other commodities imported in increased quantity may be mentioned iron ore, wood pulp, and palm oil, each of which were also imported in greater quantity in the first six months of the year.

Retained imports of manufactured articles were valued at £13,522,000, or 23 per cent. more than in July, 1933. The increase was nearly general, decreases being recorded for only four groups, and of these the largest was £40,000 in respect of apparel. The largest increases were in retained imports of iron and steel, non-ferrous metals and machinery. For vehicles, a very heavy relative increase was recorded, due to larger imports of motor-cars, mainly from the United States.

The increase in exports of United Kingdom goods has already been mentioned. In respect of food, drink and tobacco, there was a small increase in value, due largely, as in previous months this year, to increased exports of spirits to the United States. For raw materials there was a small decline, owing to reduced exports of wool. Coal increased in value by £109,000 and in quantity by 108,000 tons (3 per cent.). The increase was essentially in exports to the foreign countries with which Trade Agreements were concluded last year, the total to these countries increasing from 931,000 tons to 1,234,000 tons. Exports to France, Italy, Belgium and the Irish Free State continued to decline. The value of exports of

manufactured articles in July (£26,048,000) has only been exceeded twice in the past three years, and the improvement was considerable both in respect of textiles and the heavy industries.

The value of the exports of cotton yarns and manufactures last month, £5,162,000, was higher than in any month since March, 1933, the increase being principally in piece goods. These amounted to 15.4 million square yards (10 per cent.) more than in July, 1933, there being an increase from 26.8 to 50.3 million square yards in exports to India and substantial increases to Canada, South Africa, Cuba and Chile. On the other hand there were heavy reductions in exports to Colombia, Morocco, Turkey and Switzerland. The increase for woollen and worsted goods was likewise in respect of the more finished goods—a decline being recorded for both tops and yarns, very largely in the exports to Germany. Exports of tissues and carpets each showed a considerable increase. For the group as a whole the increase in value was £275,000 (12 per cent.). The value of the exports of manufactures of silk, artificial silk, linen and hemp, and jute was in each case greater in July than a year earlier, and exports of apparel, other than boots and shoes, increased from £643,000 to £706,000.

The value of the exports of iron and steel and manufactures thereof, £3,154,000, was higher than in any month since November, 1930, the increase as compared with July, 1933, being £713,000. The tonnage exported was larger by 41,000 tons (26 per cent.) and for the first seven months of the year the increase was 174,000 tons (16 per cent.). The machinery exported in July was higher by £548,000 in value and by 5,500 tons (23 per cent.) in quantity than a year earlier, and for the seven months a similar proportionate increase was recorded. Locomotives and new ships and boats contributed very little to the month's total, but exports of aeroplanes and parts were valued at over £100,000 more than in July, 1933. The number of motor-cars and chassis exported increased by 26 per cent. and for the seven months there was an increase of 4,543 (15 per cent.), the value of the exports increasing from £3,861,000 to £4,646,000.

Imports and exports of bullion and specie were slightly smaller in July than in previous months. For the seven months ended July imports amounted to £213 million and exports to £111 million. The excess of imports over exports during this period, £102 million, was very similar to that during the corresponding period of last year, viz. £106 million, but this year the main accumulation (£72 million) was in the first quarter of the year, whereas in 1933 the import excess for that quarter was only £13 million and amounted to £76 million in the three months ended July.

The volume of exports in the second quarter of the year, as calculated by the Board of Trade, was about $8\frac{1}{2}$ per cent. higher than a year earlier. To some extent this increase may be attributable to the whole of the Easter holiday being in April last year and only half in April this year when Easter Sunday fell on April 1. For the first half of the year the increase in the volume of exports was 7 per cent., this also being the increase in respect of manufactured articles exported. For raw materials the increase was only 3 per cent., but there was an increase of 15 per cent. in respect of food, drink and tobacco, due to a considerable extent to larger exports of spirits to the United States. In the first half of this year the volume of exports was higher than in the corresponding period of any year since 1930, but in relation to that period it showed a decline of 23 per cent. Retained imports were 9 per cent. more than in the first half of last year, showing the usual seasonal decline in the second quarter compared with the first. The expansion compared with last year was mainly in raw materials and articles wholly or mainly manufactured which increased respectively by 16 and 21 per cent., but there was also a small increase in respect of food, drink and tobacco. The increase applied to all the groups of raw materials and manufactured articles except raw wool and rubber manufactures.

The general level of prices as measured by the Board of Trade index-number showed very little change during July, 1934, the continued rises in the prices of cereals being offset by decreases in the prices of other articles of food and of some materials. The index-number for cereals advanced from 82.7 to 86.1, or 4.1 per cent., whereas the index-number for all articles of food moved only from 81.8 to 82.0, and that for materials declined from 89.7 to 89.4. The general index-number for June was 86.8 and for July 86.7 (1930 = 100). Prices of imported wheat had in July advanced 22 per cent. since April and flour about 16 per cent. The advance is almost entirely due to the anticipated fall in production owing to the general drought in the wheat-producing areas of North America and not to any prospects of increased consumption. There was some advance in the prices of British beef, but prices of imported beef, mutton and bacon showed some decline. Among materials there was an appreciable rise in the price of American cotton ($5\frac{1}{2}$ per cent.) due principally to adverse reports as to drought and to low crop-estimates. Rubber continued to rise in price (8.8 per cent.) and leather prices advanced slightly. On the other hand, wool prices have continued to fall and are now nearly 19 per cent. below the high prices ruling at the beginning of the year. Copper continued to fall, but there was some rise in the price of tin during the month.

The Board of Trade index-numbers (1930 = 100) for the last three months are given below.

Month.	Total Food.	Total not Food.	All Articles.
May, 1934	78.9	89.8	85.8
June, 1934	81.8	89.7	86.8
July, 1934	82.0	89.4	86.7
<i>July, 1933</i>	<i>80.1</i>	<i>88.8</i>	<i>85.6</i>
<i>July, 1932</i>	<i>85.3</i>	<i>80.0</i>	<i>81.8</i>

Wholesale food prices were, at the end of July, 1934, about 3 per cent. below the level of prices prevailing at the time (Sept. 19, 1931) when in Great Britain the gold standard ceased to govern current issues. Materials were about 10 per cent. in advance of those prices.

Compared with the level of prices in 1913 articles of food showed an advance of 3.9 per cent. in prices, and materials about 3.2 per cent. Compared with 1924 both groups declined rather more than 37½ per cent.

The *Economist* general index-number advanced about 1 per cent. during the period June 20 and Aug 1, 1934, and at the latter date stood at 66.0 (1927 = 100). This increase was also principally due to an advance in the index-number for cereals and meat of about 7.6 per cent., prices of materials except rubber and cotton showing a decline.

The *Statist* general index-number for July, 1934, 182.4, showed a rise of 2.1 per cent. compared with June (80.7), and this was accounted for in great measure by the increase in the price of potatoes, the index-number for which stood at 123.9 for July compared with 76.9 for June (average of 1866-77 = 100). Considerable increases occurred also in the prices of grains.

Some of the British index-numbers and those for France, Germany and the United States are given below for the three months May-July, 1934 (1913 = 100).

	Board of Trade.	<i>Economist</i> .	<i>Statist</i> .*	U.S.A. (Bureau of Labour).	France (<i>Stat. Gen.</i>).	Germany (<i>Stat. Reichsamt</i>).
May, 1934	102.4	90.0	81.1	105.6	372	96.2
June, 1934	103.6	89.9	80.7	106.9	363	97.2
July, 1934	103.4	90.8	82.4	107.2	361	98.8
<i>July, 1933</i>	<i>102.3</i>	<i>89.9</i>	<i>81.7</i>	<i>98.7</i>	<i>397</i>	<i>93.9</i>

* 1866-77 = 100.

The increase during the last few months in the index-number for the United States is due to the advance in prices of grains and other

food products and of cotton, the prices of materials having on the whole moved in an opposite direction.

The cost of living index-number prepared at the Ministry of Labour showed a further advance in July, 1934, and at August 1, stood at 42 per cent. above the level of July, 1914. The movement was entirely due to slight increases in the prices of butter and eggs, offset to some extent by a fall in the price of potatoes. Since the beginning of May food prices have risen about 6 per cent. and the index-number for these articles was at August 1, 123 compared with 116 at May 1, 1934 (July, 1914 = 100). Compared with July, 1914, prices of fish have advanced nearly 100 per cent., milk 65 per cent., beef and mutton (best joints) from 40 to 50 per cent., tea and bread about 30 per cent. On the other hand, butter, margarine and the inferior portions of beef and mutton are all lower in price than at July, 1914.

The monthly return of retail sales prepared by the Bank of England and the Association of Retail Distributors showed an increase in July of 3.1 per cent. compared with the sales for July, 1933. The increase applied to all five districts—Scotland, North of England and Wales, South of England and London Central and West End, and Suburban. In Suburban London the increase was 6.1 per cent. Taking the six months February to July, 1934, the total sales were 3.0 per cent. above those for the same period in 1933, and all the principal branches and departments indicated an increase with the exception of that for piece goods.

Shipping freights, which had fallen during June and had shown a fairly continuous decline since December, 1933, improved appreciably in July and the index-number prepared by the Chamber of Shipping advanced from 17.22 for June to 18.49 (1920 = 100) for July, an increase of about 7.4 per cent. Compared with July, 1933, however, the improvement was about 1 $\frac{3}{4}$ per cent. Prevailing freight rates are below those for 1913 and those obtaining during the period 1923–1929.

The steady appreciation in the value of Fixed Interest Stocks which has been noticeable during the greater part of the last two years, but was arrested in May and June 1934, reasserted itself during July, and the index-number for the Stock Exchange Values of these securities rose to 127.1 at July 19 (December 1921 = 100), the highest point reached since the commencement of the index-number. The most important advance was in British Railway preference stocks, which rose 2.5 per cent. during July after a slight set-back in April and May. On the other hand, the values of variable dividend

securities again showed some decline, the index-number receding from 114.5 to 112.9, or 1.4 per cent. The decline was fairly general, being greatest in American Railway Shares. British Bank and Insurance Shares advanced and there was a marked recovery in British Railway Ordinary Stocks. The index-numbers for the four months, April to July, 1934, are given below (December 1921 = 100).

	Fixed Interest Stocks.	Variable Dividend Security.	Total.
April 18, 1934	126.9	117.3	123.8
May 18, 1934	125.8	115.9	122.6
June 19, 1934	125.3	114.5	121.8
July 19, 1934	127.1	112.9	122.5
July 19, 1933	117.9	111.7	115.9

The following table gives for the British Dominions and principal foreign countries the percentage increases on July 1, 1933 * and on the latest available date in the retail prices of food and other articles (rent, clothing, fuel, etc.) compared with the prices at July, 1914.*

	Retail Prices of Food at		Retail Prices of All Items at		Date of Latest Return.
	July, 1933.*	Latest Date available.	July, 1933.*	Latest Date available.	
Great Britain	18	23	38	42	Aug. 1, 1934
<i>British Dominions, etc.</i>					
Australia	18	19	18	19§	June, 1934
Canada	— 5	1	20	22	June, 1934
Irish Free State	29	29	49	49	May, 1934
New Zealand	4	11	27	29	June, 1934
South Africa	— 2	4	14	16	June, 1934
<i>Foreign Countries.</i>					
Austria (Vienna) ..	4	0	5	5	July, 1934
Belgium	—	—	595	554	July, 1934
Czechoslovakia (Prague)	562	553	596	595	June, 1934
Denmark	—	—	60	66	July, 1934
Egypt (Cairo)	1	7	24	23†	Mar., 1934
Finland	777	723	883	848	June, 1934
France (Paris)	408	391	416‡	422§	July, 1934
Germany	11	16	19	22	June, 1934
Holland (Amsterdam) ...	17	23	37	40	June, 1934
Italy	293	264	250||	244¶	July, 1934
Norway	32	30	48	47	May, 1934
Spain (Madrid)	79	86	—	—	April, 1934
Sweden	23	25	53	55	June, 1934
Switzerland	16	15	31	29	June, 1934
United States	5	8	28	35**	May 8, 1934

* Or nearest date available.

† May 1934.

‡ 3rd Quarter.

§ 2nd Quarter. || July-Dec. 1933.

¶ Jan.-June 1934.

** Dec. 1933.

Unemployment in Great Britain increased during July and the numbers recorded as unemployed on the registers of the Employment Exchanges of the Ministry of Labour rose from 2,092,586 at 25th June to 2,126,260 at 23rd July, an increase of 33,674. There was a decrease of nearly 10,000 in the number wholly unemployed and of over 2,000 in the numbers usually in casual employment, but the numbers temporarily stopped rose by about 45,500. There was an increase of nearly 14,000 in the number of boys and girls on the register due to increased registration at the end of the school term, but this is a yearly experience in July and although the increase is somewhat larger than in 1933 it is not quite as high as in 1932. There has been an increasing tendency during the last few years for workpeople to register at the exchanges during statutory or local customary holidays in order to qualify as rapidly as possible for benefit in the event of subsequent unemployment, and this practice is liable to affect perceptibly the number recorded as unemployed, especially in certain industries and areas. In July, for example, the numbers unemployed in the jute industry were doubled and practically two-thirds of the operatives in the trade were on the registers owing to local holidays. Jute is an industry located in a comparatively small area and the effect of holidays is at once noticeable, but the practice is now extensive both as regards trades and districts. Employment in the woollen and worsted trade has been declining almost continuously during 1934, and at the end of July the rate of unemployment had risen to 24.1 per cent. as compared with 9.2 per cent. at the end of December, 1933. At the end of July, 1933, the proportion unemployed was 13.0 per cent. Employment decreased appreciably in the cotton and clothing trades and to a somewhat less extent in the building industry and in most of the miscellaneous metal trades. On the other hand, there was an improvement in coal and other mining, engineering and shipbuilding. The rate of unemployment in shipbuilding (44.7 per cent.) is still higher than in any other industry, but it is followed closely by Public Works Contracting (43.9 per cent.).

The proportion unemployed in Great Britain and Northern Ireland at the end of July was 16.8 per cent. compared with 16.5 per cent. at the end of June and 19.5 per cent. at the end of July, 1933. All districts showed some decline in employment except Wales and the North-Eastern area. In Wales, however, the rate of unemployment was 32.3 per cent. Unemployment was lowest in the South-Eastern district (7.2 per cent.); London (8.5 per cent.) and South-Western district (11.7 per cent.). In Scotland, Northern Ireland and the North-Eastern district the rate was 23.2 per cent.

for each area; it was 20.4 per cent. in the North-Western district and 14.2 per cent. in the Midlands.

The numbers on the registers of the employment exchanges of Great Britain at the end of the last three months are given below.

Date.	Wholly Employed.	Temporarily Stopped.	Persons Normally in Casual Employment.	Total.
May 14, 1934	1,658,677	341,028	90,676	2,090,381
June 25, 1934	1,563,432	447,320	81,834	2,092,586
July 23, 1934	1,553,747	492,872	79,641	2,126,260
July 24, 1933	1,855,214	501,702	85,259	2,442,175

In Germany the total number of persons reported by the Employment Exchanges as unemployed continued to decrease and at the end of July, 1934, had fallen to 2,426,387, of whom 762,204 were in receipt of poor relief and 1,089,000 in receipt of either standard unemployment benefit or emergency benefit. The corresponding figures for June, 1934, were 2,480,826 and 796,921, and for July, 1933, 4,463,841 and 1,766,286 respectively. At the end of June, 1934, 15.6 per cent. of the 6,737,455 members of the German Labour front were recorded as unemployed compared with 14.9 per cent. at the end of May. Apparently persons engaged on voluntary labour service and on relief works are excluded from the numbers recorded as unemployed.

In France there was a slight falling off in employment during the month and it continued worse than in the corresponding period of 1933. In Norway, Sweden and Denmark employment showed some slight improvement on the whole during June, and in Italy employment improved appreciably. In Austria and Czechoslovakia employment has continued to improve, and this is the case to a somewhat slighter degree in Poland, where, however, it is not so good as a year ago. In Holland and Belgium there appears to be little change.

In the United States employment fell away to some extent in June and July, and at the end of the latter month the index-number of employment (1923-5 = 100) had dropped to 76.0 compared with 81.0 in June and 82.4 in May, 1934. Employment was no doubt temporarily affected to some considerable degree by actual and threatened labour disputes.

Employment in Canada has noticeably improved since the beginning of April, and at the beginning of July the index-number of employment (1926 = 100) had risen to 101, the highest figure recorded since November, 1931.

Everyone who has ever conducted an investigation into any statistical subject has had to spend a great amount of time in ascertaining the sources of the information he is seeking, and we can, therefore, extend a hearty welcome to *The Economist's Handbook, a Manual of Statistical Sources*, compiled by Gerlov Verwey of the General Research Department of the Netherlands Trading Society with the help of D. C. Renouij of the Netherlands Economic Institute. It is a stout volume of ix + 460 pages published at Amsterdam (Amstel 20-22), and Professor Parker Willis of Columbia University in an introductory note describes it as a "pioneer effort at the improvement and internationalization of statistics." Mr. Verwey says: "A few years ago the thought struck me that a handbook classifying existing sources of the main countries and indicating where one may find statistical data on any given economic subject and information about the contents, name, ordering address, price and merits of a given statistical publication would very much meet with an existing need." That ideal he has tried to live up to in this handbook, utilizing not only official but unofficial publications. In the first part he deals with subjects classified alphabetically, showing by countries the nature of the information recorded and the publications in which it is to be found. In the second part the sources are classified by countries, giving detailed data on the name, price, and character of the source, distinguishing annual, quarterly, and other issues, supplements, and irregular publications. To each country section a brief note is prefixed, indicating the base books and sources of recent material. Finally, an alphabetical index of all the sources classified (covering 42 pages) is given with a reference to the page in the *Handbook* where it is used; in this list the *Journal* of this Society does not appear, surely a grave omission. There does not appear to be any indication of the price of the book.

The Statistical Year Book of the League of Nations for 1933-34 (Allen and Unwin, 299 pp., 10s.) has recently been issued. As stated in the Preface, its object is "to give an international synopsis of available statistics relating to the most important demographic, economic, financial and social phenomena. In each table, as many countries as possible are included, and the statistics are rendered, as far as possible, comparable over the period covered; when more is not possible, then at least for each country separately." A number of the tables have been improved in scope and presentation so as to make more strict the comparability of the various national series. This publication is now so well known that it is unnecessary to praise Mr. Loveday and his colleagues for its compilation. It is indis-

pensible to every student of international affairs. Somewhat similar in scope is the *Recueil International de Statistiques Économiques*, 1919-30, just published by l'Institut Internationale de Statistique (La Haye; price 4 Dutch florins). It includes annual and monthly figures relating to forty or fifty important economic indices for fifteen countries, accompanied by a short commentary and a calendar of the chief economic occurrences in each country. The Stationery Office has also published for the Colonial Office a foolscap volume of v + 575 pages (price 25s.) of *An Economic Survey of the Colonial Empire* (1932). It is "an attempt to assemble within a single volume all the essential facts relating to the economic situation of the Colonial Empire, that is, of the non-self-governing Colonies, the Dependencies of certain of those Colonies, the Protectorates (other than the Protectorates of the South African High Commission), the Protected States in Malaya and Borneo and the Mandated Territories of His Majesty's Government in the United Kingdom. . . . The information contained herein has been collected from a number of sources, Colonial Blue Books, Colonial Annual Reports, other official reports of Colonial Governments, publications of the Imperial Institute, the Imperial Economic Committee, and the Empire Marketing Board, and other sources, official and unofficial, both published and unpublished." Lastly, a distinct and important addition to statistical knowledge is to be found in the Special Memorandum No. 37, *An Index-Number of Securities, 1867-1914*, compiled for the London and Cambridge Economic Service by K. C. Smith and G. F. Horne. Monthly indices are given for eleven groups of industrial shares and a combined index; 26 shares for 1870 and 80 for 1910 are utilized. This Memorandum, like all the others in the series, is issued only to subscribers.

The Draft Programme of the Sixth International Congress for Scientific Management, which will be held in London next July, has been forwarded to the office of the Society. The purpose of the Congress is to discuss "practical applications of scientific management in all its phases," and should, therefore, be of particular interest to members of our new Industrial and Agricultural Research Section. The subjects for the two plenary sessions will be chosen early in 1935 from current "questions of immediate and world-wide practical importance and interest in the field of business management." During the week of the meeting six Sections will hold discussions. The Manufacturing Section, dealing with methods of controlling production, will consider budgetary control, standards, and forecasts, scientific methods in management, production control to meet

changes of product, etc., and production management technique. The theme of the Agricultural Section is standardization as a factor in agricultural development, and its topics include mechanization, accounts, preparation of produce for market, and specialized and mixed farming. The Distribution Section will treat of the methods applied to distribution problems by manufacturers, wholesalers, and retailers, and the Development Section will investigate "the correct methods of inculcating modern management principles and practices in large-scale, medium, and small undertakings" and the rôle of institutions, trade, and other associations. The Educational and Training Section will discuss methods of selection, education, and training of persons suitable for high administrative posts. Lastly, the Domestic Section, under the guidance of Professor Winifred Cullis, will attempt to ascertain how far scientific management in the home can contribute to the raising of the standard of life; special topics will be food planning in the home, the technique of scientific management in the home, development of scientific home management in rural areas, and the part of organized services outside the home in relation to scientific management in the home. Further, in addition to any papers submitted to the various Sections, National Committees have been invited to submit "a limited number of outstanding contributions . . . original studies based on actual practice." It is plain that statistical methods must be employed in very many of the investigations conducted by the Congress, and for that reason the Royal Statistical Society is among the 63 British institutions which send representatives to the Council of the Congress, while on the Executive Committee are our Fellows Sir R. Hadfield, Mr. B. Seeböhm Rowntree, and Sir Josiah Stamp. The offices of the Congress are at 21 Tothill Street, London, S.W. 1.

A further development in the teaching of statistical methods is announced, which has been largely influenced by the formation of the Industrial and Agricultural Research Section of the Society. The Chelsea Polytechnic has arranged that in its forthcoming session a lecture and laboratory course will be given "on the application of statistical method to science and industry." The preliminary announcement which we have received refers to the formation of the Royal Statistical Society's Research Section as an unmistakable sign of the importance of this comparatively recent development of the science of statistics, and it is explained that, since at present the knowledge of the methods involved is confined to the expert, the course at the Polytechnic will "introduce the subject in a practical and elementary manner to the industrial and scientific worker." It

is further stated that the course will be suitable for students with only an elementary knowledge of mathematics and will be developed as an aid to workers in all branches of science and industry who have occasion to analyse numerical data; in the practical work facilities will be provided for working at problems of particular interest to the industrial student. The classes will be held weekly and the hours will be from 7 to 9 p.m. Further particulars are obtainable from the Mathematics Department, Chelsea Polytechnic, Manresa Road, S.W. 3.

OBITUARY.

HENRY RAMIE BEETON.

HENRY RAMIE BEETON, a life-member of the Royal Statistical Society from 1882, served on the Council from 1891 to 1897, was a member of the Dinner Club, and was a donor to the Library. He died in London 20th June of this year, at the age of 83. For some years he had lived in retirement at Checkendon, near Reading, and appeared but rarely at our general meetings.

He is known to the daily journals as "Pioneer in the Electricity Supply Industry." He was so, both for lighting ("House to House Electric Supply Company" in the 'eighties, in Kensington, etc., etc.), heating, and cooking (Restaurant Company, Chelsea Electric Supply Company, London Power Company). On retirement he devoted himself to stock-raising and was made honorary member of the National Pig Breeders' Association.

But he had always room in his heart for economics, statistics, currency, and Bimetallism. It was he who described Manchester as the Mecca of Bimetallism. He was one of those whose influence is greater than his fame. The little group of economists meeting in his drawing-room at Maresfield Gardens for debates in the early 'eighties included Edgeworth, Wicksteed, Shaw, and Foxwell. Their proceedings contributed to the foundation of the British Economic Association (now the Royal Economic Society) in 1890, under the Presidency of Viscount Goschen. Goschen was our own President 1886-88 (see the *Annals of the Royal Statistical Society*, Centenary vol. pp. 169, 191, 296, and compare Goschen's *Essays*, reprinted 1905, pp. 222 to 281).

Goschen died in 1907. He was the President of the Royal Economic Society and longest in the chair. It was to our friends there that H. R. Beeton in 1890 presented, anonymously, the portrait of Goschen by A. E. Emslie. This is the portrait hung in our rooms at Adelphi Terrace. An old member of the Society* who was in Beeton's confidence wrote to him in May of this year that surely the time had come for the label to be renewed and the donor's name inserted. He consented, a few weeks before his death.

After his retirement from London, Beeton's primary interest was in agricultural research to which he was led by his hobby of stock-raising and his dissatisfaction with the state of knowledge of infec-

* Usually writing under the initials H. H.

tious diseases in farm animals. Shortly before the War he interested the present President of the Royal Statistical Society in the statistical study of swine fever and although the research planned, like so many more important things, was brought to nothing by the pressure of war service, Professor Greenwood tells me that the preliminary joint work was the beginning of a friendship only broken by death. In his latest years Beeton concentrated on the academic development of agricultural research and was a firm friend and supporter of the University of Reading.

Many men now eminent will recall the generous hospitality and still more generous sympathy and encouragement which they received from Mr. and Mrs. Beeton whether in Hampstead or in their charming country house.

J. B.

STATISTICAL AND ECONOMIC ARTICLES IN RECENT PERIODICALS.

UNITED KINGDOM—

Agricultural Economics Society, Journal of Proceedings—

*March, 1934—*The state and agriculture: *J. A. Venn* (presidential address). The distribution of the national income: *D. A. E. Harkness* (with discussion).

*Bankers' Magazine, August, 1934—*The banking half-year. Central banking in the Empire: *Argonaut*. Credit and trade: *C. T. A. Sadd*.

*Eugenics Review, July, 1934—*Eugenic influences in economics: *Sir Josiah Stamp*.

*Lloyds' Bank Monthly Review, July, 1934—*Trade recovery and the future: *O. R. Hobson*.

Midland Bank Monthly Review—

*June-July, 1934—*External trade and internal recovery.

*July-August, 1934—*Gold as an article of British commerce 1932-1933-1934.

Ministry of Agriculture, Journal—

*July, 1934—*The Rothamsted holdings. Council of Agriculture for England. [42nd meeting.]

*August, 1934—*Live Stock Improvement Scheme Report.

*Planning, July, 1934—*The use of statistics.

*Review of Economic Studies, June, 1934—*A contribution to the theory of price fluctuations: *J. B. S. Haldane*. The working of the pre-war gold standard: *C. H. Walker*. The German method of combined debt liquidation and export stimulation: *H. K. Heuser*.

*Royal Meteorological Society, Quarterly Journal, July, 1934—*An investigation of the statistical probability of rain in London: *D. Dewar*.

*Royal Society of Arts, Journal, August 3, 1934—*The jute industry: *Sir Alexander Murray*.

*Royal Sanitary Institute, Journal, July, 1934—*The technique of rehousing, etc., from slum areas: *Cyril H. Walker*. The housing and slum clearance problem in Portsmouth: *A. E. Allaway*.

Westminster Bank Review—

*June, 1934—*Trends in Britain's overseas trade.

*July, 1934—*The distribution of recovery in Britain.

AUSTRALIA—

*Economic Record, June, 1934—*Australian policy in the depression: *R. G. Hawtrey*. Some aspects of depression psychology in New Zealand: *T. A. Hunter*. Protection and the price level in Australia: *C. H. P. Gifford*.

INDIA—

Indian Journal of Economics, April, 1934—The trend of Indian birth rates in the perspective of comparative demography: *Benoy Kumar Sankar*. Plain living and high thinking: a study: *S. A. Samad*.

UNION OF SOUTH AFRICA—

South African Journal of Economics, June, 1934—The future of gold in relation to demand: *Edwin Cannan*. Business cycles in South Africa, 1910–1933: *Prof. C. G. W. Schumann*.

UNITED STATES—

American Academy of Political and Social Science, Annals, July, 1934—The world trend toward nationalism [Whole number].

American Economic Review, June, 1934—Currency inflation: nature and implications: *Walter E. Spahr*. Forecasts of general price level: *Erwin Graue*. Currency of Canada: *James Holladay*. Gold, debt and prices: *Thornton Cooke*.

American Philosophical Society, Proceedings—

May, 1934—Conservation and evolution in a changing social program: *John C. Merriam*.

July, 1934—The economic implications of national planning: *Frederic A. Delano*. Stabilization of the currency: *Ray B. Westerfield*. Problems of Government ownership and operation of the railroads: *Emory R. Johnson*. Some subjective factors affecting industrial recovery: *Samuel Price Wetherill*.

American Statistical Association, Journal, June, 1934—The completeness of birth registration in the United States: *P. K. Whelpton*. Evaluating 1933 for the farmer: *Mordecai Ezekiel*. Some methods for statistical analysis: *W. B. Kemp*. Unemployment rates, insurance benefit and contribution scales in Germany and Great Britain: *Arnold Tolles*. A two-way distribution of price changes: *Henry B. Arthur* and *Laurence W. Conant*. The average value of the sum of absolute differences of paired ordinals of two ordinal series: *J. Spier*. The adjustment of time data for the influence of Easter: *Leroy M. Piser*.

Econometrica, July, 1934—William Stanley Jevons: *H. Winefred Jerons* and *H. Stanley Jerons*. Developpements récents de la technique statistique: *G. Darmons*. A critical examination of Professor Pigou's method of deriving demand elasticity: *R. G. D. Allen*. Circulation planning: proposal for a national organization of a commodity and service exchange: *Ragnar Frisch*.

Harvard Business Review, July, 1934—British experiments in the reduction of excess industrial capacity: *Arthur F. Lucas*. Competitive currency depreciation between Denmark and New Zealand: *C. P. Kindleberger*. The scientific study of the industrial worker: *T. N. Whitehead*.

UNITED STATES—*Contd.*

Journal of Political Economy, June, 1934—Some considerations on unemployment insurance in the light of German experience : *Otto Nathan*. National social insurance in France : *William Oualid*. Egypt's balance of trade : *C. Bresciani-Turroni*. The French solution for the railway problem : *Herbert E. Dougall*.

Milbank Memorial Fund Quarterly, July, 1934—Sickness and the depression : *G. St. J. Perrott* and *Selwyn D. Collins*. Second progress report on a study of family limitation : *Raymond Pearl*.

Review of Economic Statistics, June, 1934.—General economic conditions in the United States : Editorial. British, French, and German conditions : (communicated). The N.R.A. and business improvement : *R. S. Meriam* and *W. L. Crum*.

Wheat Studies of the Food Research Institute, June-July, 1934—Decline and recovery of wheat prices in the 'nineties [Whole number].

ARGENTINA—

Revista de Ciencias Económicas—

April, 1934—Análisis de la curva de Pearl y Read : *José Barral Souto*.

May, 1934—Estado de la deuda pública por presidencia (1910-1931) : *Demetrio E. Luisi*. Nuestras relaciones económicas con Canadá : *Ricardo E. Galbusera*.

BELGIUM—

Revue du Travail, June, 1934—La standardisation : *Gustave-L. Gérard*.

CHINA—

Monthly Bulletin on Economic China, May, 1934—The cooperative movement in China : *H. D. Fong*.

CZECHOSLOVAKIA—

Revue Statistique Tchecoslovaque, July, 1934—Aperçu des résultats les plus importants du dernier dénombrement de la population : *Ant. Bohac*. Aperçu historique des tables de mortalité de la population : *Jos. Florian* and *Mil. Stastny*.

[Czech text. French summary.]

DENMARK—

Nationaløkonomisk Tidsskrift, Hefte 3, 1934—Offentlige Arbejder som Middel Mod Arbejdsløsheden : *Jørgen S. Dich*. Finlands Ekonomiska Utveckling Såsom Förutsättning för dess Politiska Självständighet : *Leo Harnaja*. En Undersøgelse af Arbejdsløn og Leveomkostninger i Sverige 1830-1930.

EGYPT—

L'Egypte Contemporaine, March-April, 1934—The great experiment in America: *S. E. Ahmed Abd el Wahhab Pasha*. La crise et la politique monétaire du Président Roosevelt: *S. Landshut*.

FINLAND—

Sosialinen Aikakauskirja, No. 6, 1934—Aperçu de la littérature en finnois de la politique sociale, 1: *Eino Kuusi*. [Swedish and Finnish text.] Les accidents d'automobile et leurs causes en 1933, VI-VIII. [Swedish and Finnish text. French summary.]

FRANCE—

Bulletin de Statistique et de Législation Comparée, January, 1934—Les fabriques de sucre et leurs procédés de fabrication en 1932-33. La Banque de France en 1933.

Bulletin de la Statistique Générale de la France, April-June, 1934—Le commerce des territoires français d'outre-mer: *Pierre Depoid*.

Journal des Economistes—

June, 1934—Le réforme fiscale: *Édouard Payen*. La B.R.I. et l'étalon or: *E. P.* La crise allemande: *L. Planche*.

July, 1934—Où en est l'héritage de 1933 à la fin du premier semestre de 1934?: *Édouard Payen*. Vers la solution du problème des dettes extérieures: *Élémer Hantos*.

GERMANY—

Allgemeines Statistisches Archiv, Heft 1, 1934—Jubiläumstagung des Internationalen Statistischen Instituts in London 1934: *Friedrich Zahn*. Die Behördenkosten bei Reichswahlen und Reichsabstimmungen 1930-1933: *Georg Kaisenberg*. Die zweite und dritte Tagung des Internationalen Ausschusses statistischer Sachverständiger: *G. Fürst*. Enquêtelehren für die Statistik: *L. Achner*. Der Stand und die nächste Zukunft der Konjunkturforschung: *G. Donner*.

Blätter für Versicherungs-Mathematik, July, 1934—Bemerkungen zur Aufstellung versicherungstechnischer Bilanzen der reichsgesetzlichen Invalidenversicherung: *Berthold Heinicke*. Die analytische Ausgleichung einer Sterbetafel mittels der Methode der "Momente": *Eugen Thoma*. Ergänzungen betreffend den Charakter der abgekürzten Todesfallversicherung: *Karl Freudenberg*. Der Charakter der Todesfallversicherung: *Klemens Löer*.

Weltwirtschaftliches Archiv, July, 1934—Allgemeine Grundlagen des Kombinationsproblems: *Richard Kerschagl*. Die Politik der mengenmässigen Einfuhrregulierung: *Kurt Häfner*. Die volkswirtschaftliche Bedeutung der Neuschaffung deutschen Bauerntums: *Hans-Jürgen Seraphim*. Der Weltluftverkehr im Jahre 1932-33: *Carl Hanns Pollog*.

GERMANY—*Contd.*

Zeitschrift für die Gesamte Versicherungs-Wissenschaft, July, 1934—
Der Umbau der deutschen Sozialversicherung: *Johannes Krohn*. Der X. Internationale Kongress für Versicherungswissenschaft in Rom: *Wilhelm Schweer*. Der technische Fehlbetrag in den Versicherungsbilanzen: *Max Gürtler*.

ITALY—

Annali di Economia, June, 1934—

Whole number consisting of Reports presented by the Italian National Commission for Intellectual Co-operation to the Second International Conference for the Study of the State and Economic Life, convened by the League of Nations; including papers by *A. De Stefani*, *L. Amoroso*, *A. Serpieri*, and *G. Mortara*.

Le Assicurazioni Sociali, March-April, 1934—La politica edilizia del Governo inglese: *Sir Hilton Young*. L'assicurazione contro la tubercolosi nel quadro delle assicurazioni sociali: *Cesare Biondi*. I diversi sistemi finanziari d'assicurazione invalidità, vecchiaia e superstiti nell'esperienza germanica: *Maria Castellani*.

[A Supplement contains these articles in English, French, and German respectively.]

Economia—

June, 1934—Sullo squilibrio tra capacità di produzione e capacità di consumo: *Livio Livi*. L'economia e la politica commerciale del Giappone: *G. C. Majoni*. Sui problemi dell'esportazione: *G. P. Zaccherini*.

July, 1934—Sulle variazioni stagionali dei fenomeni economici: *Giovanni Lasorsa*. La rivalità finanziaria anglo-americana: *Aldo Fiaccadori*.

Giornale degli Economisti e Rivista di Statistica, April, 1934—Su di un particolare effetto economico della pressione tributaria: *Cesare Cosciani*. Per la ripresa dell'esportazione: *Oeconomicus*.

Giornale di Matematica Finanziaria, No. 1, 1934—Sul calcolo delle probabilità di sopravvivenza dei gruppi: *P. Martinotti*.

La Riforma Sociale, May-June, 1934—Limiti e metodi nel controllo dei prezzi: *Vincenzo Pori*. Prime linee di una teoria dei dopplioni: *Luigi Einaudi*. Reddito, natalità, mortalità: *Alberto Breglia*. Il bilancio dello stato negli anni della depressione mondiale: *F. A. Rèpaci*.

Rivista Italiana di Statistica, Economia e Finanza, June, 1934—Il barometro economico: *F. Vinci*. Il significato teorico e pratico degli indici dei prezzi: *D. Tenderini*. Osservazioni metodologiche sullo studio dei fenomeni economici: *H. Bolza*.

MEXICO—

Boletín de la Sociedad Mexicana de Geografía y Estadística—

January, 1934—Cómo ha sido organizada la Reunión del Instituto Internacional de Estadística: *Luis Híjar y Haro*. Sesión solemne en honor de las Delegaciones al XXI Congreso internacional de Estadística. Breve reseña histórica de la Sociedad Mexicana de Geografía y Estadística: *Luis Híjar y Haro*. Alocución por el Dr. Frederic Zahn, Presidente del Instituto Internacional de Estadística (Avec traduction française).

April, 1934—El problema judío en Polonia: *S. S. Zygmunt Merdinger*.

RUSSIA—

Agrar-Probleme, Part 3, 1934—Zu einigen Fragen der internationalen Bauernbewegung: *W. Kolarow*. Die Ergebnisse der Frühjahrssaatkampagne und die Aufgaben der Getreidebeschaffung in der UdSSR: *Bakulow*. Ergebnisse des 1. Fünfjahrplans auf dem Gebiete der Landwirtschaft.

SWEDEN—

Ekonomisk Tidskrift, Häft 2, 1934—Nationalekonomiska kontroverser: *David Davidson*. Adam Smith och Sverige: *Åke Malmström*.

Index—

June, 1934—The world's commercial banks since 1920: *Sven Brisman*.

July, 1934—The lesson of Australia: *R. C. Mills*.

INTERNATIONAL—

L'Esprit International, July, 1934—Du protectionnisme à la dictature par l'économie dirigée: *Gustav Cassel*. L'autarchie économique: *Giuseppe de Michelis*.

International Labour Review—

June, 1934—The reduction of the working week in Germany. The economic depression and public health: *Dr. R. Paula Lopes*.

July, 1934—Economic depression and its causes: *Mentor Bouniatian*. Unemployment relief in Australia: *F. A. Bland*.

International Review of Agriculture, May, 1934—Comprehensive reclamation and land improvement in Italy: *G. Costanzo*.

Revue de l'Institut International de Statistique, Livr. 1, 1934—On statistical methods: *H. Westergaard* (avec résumé français). Méthodes pour calculer les taux de mortalité infantile selon les mois de l'année: *M. Ptoukha* (avec résumé anglais). La XXIIe Session de l'Institut International de Statistique, Londres 1934: *C. A. Verrijn Stuart*.

LIST OF ADDITIONS TO THE LIBRARY.

Since the issue of Part III, 1934, the Society has received the publications enumerated below :—

I.—OFFICIAL PUBLICATIONS.

(a) United Kingdom and its several Divisions.

United Kingdom—

Agriculture and Fisheries, Ministry of. Bulletin No. 77. Tomatoes: cultivation, diseases and pests. London: H.M.S.O., 1934. 9½" × 6". 71 pp. 1s. 6d.

Colonial Office—

An economic survey of the Colonial Empire (1932). London: H.M.S.O., 1934. 13¼" × 8¼". 575 pp. 25s. (From the Under-Secretary of State.)

British Honduras financial and economic position. Report of the Commissioner appointed by the Secretary of State for the Colonies. March, 1934. Cmd. 4586. London: H.M.S.O., 1934. 9½" × 6". 222 pp. 4s. 6d.

General Register Office. Census of England and Wales, 1931. Occupation tables. vii + 680 pp. 30s. Classification of occupations. xi + 269 pp. 12s. London: H.M.S.O., 1934. 13¼" × 8¼". 2 vols.

Health, Ministry of. Advisory Committee on the Welfare of the Blind. Report of the Sub-Committee on marketing and other matters affecting the employment and vocational training of blind persons. London: H.M.S.O., 1934. 9½" × 6". 71 pp. 1s. 3d.

Labour, Ministry of—

Twenty-first abstract of labour statistics of the United Kingdom (1919-1933). London: H.M.S.O., 1934. 9½" × 6"; viii + 211 pp. 3s. 6d.

Unemployment Bill (brought before the Commons 15th May 1934). Explanatory memorandum on clauses. London: H.M.S.O., 1934. 9½" × 6". 52 pp. 9d.

Overseas Trade, Department of—

Reports: 577. Angola, 53 pp. 1s. 6d. 578. Australia, 164 pp. 4s. 6d. 579. Greece, 67 pp. 2s. 580. Netherlands, 105 pp. 3s. 581. France, 723 pp. 7s. 582. Germany, 228 pp. 3s. 6d. 583. East Africa, 96 pp. 3s. 3d. 584. Yugoslavia, 60 pp. 2s. 585. Norway, 94 pp. 2s. 6d. 586. Roumania, 61 pp. 2s. London: H.M.S.O., 1934. 9½" × 6". 10 parts.

(b) Dominions, Colonies, and Protectorates.

Canada—

Dominion Bureau of Statistics. Seventh census of Canada, 1931. Vol. II. Population by areas. Ottawa: 1933. 9½" × 6½". 939 pp. \$1.

India—

Bombay. Labour Office. Wages and unemployment in the Bombay cotton textile industry. Bombay: 1934. 9½" × 6". 220 pp. 2s.

Irish Free State—

Currency Commission. Quarterly statistical bulletin. Jan., April, July, 1934. Dublin: 1934. 9½" × 7". 3 parts.

Malaya—

Statistics, Department of. Malaya: average prices, declared trade values exchange, currency and cost of living for 1933. Singapore: 1934. 13¼" × 8". 46 pp. 1s. 5d.

(c) Foreign Countries.

Argentina—

Ministerios de Hacienda y Agricultura. El plan de acción económica ante el Congreso Nacional discursos de los Ministros Pinedo y Duhaú. Buenos Aires: 1934. 10" × 6½". 148 pp.

Brazil—

Ministerio de Agricultura. Boletim do Ministerio da Agricultura Ano 22, Jan.-Dez. 1933. Rio de Janeiro: 1934. 9" × 6½". 482 + v pp.

Czechoslovakia—

Office de Statistique. Statistique des impôts pour 1928. Prague: 1932. 12" × 9¼". xxxix + 449 pp.

Estonia—

Bureau Central de Statistique. Formulaire et instructions du II recensement de la population de l'Estonie 1934. Tallinn: 1934. 10" × 8". [Documents in folder.]

Germany—

Reichsarbeitsministerium—

Act for the Organization of National Labour dated 20th January, 1934. Berlin: 1934. 8¼" × 5½". 28 + 28 + 28 + 27 pp. [In German, English, French and Italian.]

The purport of the Act for the Organization of National Labour. Berlin: 1934. 32 + 28 + 29 pp. [In German, English and French.]

Italy—

Istituto Centrale di Statistica—

Annali di statistica. Serie VI, Vol. XXXII. L'azione promossa dal Governo Nazionale a favore dell' incremento demografico e contro l'urbanesimo. 105 pp. 8 lire. Vol. XXXIII. Atti del Consiglio Superiore di Statistica. Sessione ordinaria 4-5 dicembre 1933. 458 pp. 20 lire. Rome: 1934. 10½" × 7¼". 2 vols.

VII Censimento generale della popolazione 21 aprile 1931. Vol. IV. Relazione generale, Parte 2. Tavole. Rome: 1934. 11½" × 9". iv + 295 pp. 20 lire.

Ministero dell' Agricoltura e delle Foreste—

I progressi dell' agricoltura italiana in regime fascista. Rome: 1934. 9¼" × 6½". 377 pp.

Nuovi annali dell' agricoltura. Anno I, Num. I, giugno 1921—Anno XIII, Num. 1-2, giugno 1933. Rome: 1921-1933. 9¼" × 6½". 34 parts.

Mexico—

Dirección General de Estadística. Primer censo industrial de 1930. Vol. II, Parts I-XXVI. Vol. III, Parts I-IV. Resúmenes generales, Vol. I. Mexico: 1933. 9" × 17". 31 parts.

Netherlands India—

Census of 1930 in Netherlands India. Vol. II. Native population in Middle-Java and the Native States of Java. Batavia: 1934. 13½" × 9½". xix + 256 pp.

Norway—

Det Statistiske Centralbyrå. Dødelighetstabeller for det norske folk 1921/22-1930/31 (Norges Offisielle Statistikk IX. 36). Oslo: 1934. 9½" × 6¼". 79 pp.

Svineholdet, 3 april 1934 og 1933. Oslo: 1934. 9½" × 6½". 52 pp.

Statens Kornforrening. Mylnor og kvernar i Norge. Etter uppteljingar i 1927-29. I. Oslo: 1934. 9½" × 6¼". 291 pp.

(c) Foreign Countries—Contd.

Poland—

Office Central de Statistique—

Abatage du bétail 1932. Warsaw : 1934. 11½" × 8½". 33 pp.

Statistique des administrations autonomes territoriales 1931-32. Warsaw : 1934. 11½" × 8½". 33 pp.

Roumania—

Institutului Demografie si Recensământ. Buletinul demografic al României.

Anul I, 1932, Anul II, 1933, Anul III, 1934, Jan.-June. Bucarest :

1932-1934. 10½" × 7½". 20 parts.

Spain—

Ministerio de Trabajo y Previsión Social. Estadística de las huelgas.

Memoria correspondiente a los años 1930 y 1931. Madrid : 1934.

9½" × 6½". 122 pp.

Switzerland—

Eidgenössisches Statistisches Amt—

Bundessubventionen und Gesetzliche Anteile 1932. Bern : 1934. 11½" × 8½". 37 + 25 pp.

Eidgenössische Volkszählung 1 Dezember 1930. 15. Canton de Fribourg.

127 pp. 16. Kanton Graubünden. 139 pp. 17. Kantone Glarus und

Zug. 133 pp. Bern : 1934. 11½" × 8½". 3 parts.

United States—

Agriculture, Department of. A handbook of dairy statistics. Washington :

1933. 6½" × 4". 129 pp. 10 c.

Children's Bureau. Maternal mortality in fifteen states. Washington : 1934.

9" × 6". 234 pp. 20 c.

Education, Office of. Residence and migration of college students. Washing-

ton : 1934. 9" × 6". 22 pp. 5 c.

Federal Trade Commission—

Chain stores : Chain store advertising. 89 pp. Chain store price policies.

. . . 46 pp. Prices and margins of chain and independent distributors,

Detroit-drug. 51 pp. Washington : 1934. 9" × 6". 3 parts.

Practices of the steel industry under the code. Washington : 1934. 9" ×

6". 79 pp.

(d) International.

International Labour Office—

Studies and Reports, Series F. No. 14. Standard code of industrial

hygiene. Geneva : 1934 (London : P. S. King). 9½" × 6". 48 pp.

1s. 6d.

League of Nations—

Economic and Financial Section—

Committee of Statistical Experts. Report to the Council on the work of

the third session (held in London from April 12 to 14th, 1934). Geneva :

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10½" × 8½". 82 pp. 2s. 6d.

II.—AUTHORS AND MISCELLANEOUS.

Anderson (Henry W.). The railroad problem and its solution. Washington :

Railway Accounting Officers Association, 1934. 9" × 6". 54 pp.

Buchanan (Sir George S.). The Milroy Lectures on international co-operation in

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College of Physicians of London on Feb. 27th and March 1st, 1934. London :

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II.—Authors and Miscellaneous—Contd.

- Canadian Political Science Association. Papers and proceedings of the Sixth Annual Meeting. Vol. VI. Montreal, Quebec, May 1934. Toronto: 1934. 9 $\frac{1}{2}$ " \times 6". 284 pp.
- Clayton (H. Helm). World weather and solar activity. (Smithsonian Miscellaneous Collection, Vol. 89, No. 15.) Washington: Smithsonian Institution, 1934. 9 $\frac{1}{2}$ " \times 6 $\frac{1}{2}$ ". 52 pp.
- Dalton (H.), Thomas (B.), Reedman (J. N.), Hughes (T. J.) and Leaning (W. J.). Unbalanced budgets: a study of the financial crisis in fifteen countries. London: Routledge, 1934. 8 $\frac{1}{2}$ " \times 5 $\frac{1}{2}$ ". xi + 468 pp. 15s.
- Donati (D.) and Pietra (G.), editors. La ricchezza privata delle Provincie delle tre Venezie. Vol. I. Ferrari (G.). La ricchezza privata della Provincia di Vicenza. 1930. 50 lire. Vol. II. Polzer (A. de). La ricchezza privata della Provincia di Rovigo. 1934. 40 lire. Vol. III. Lasorsa (G.). La ricchezza privata della Provincia di Venezia. 1934. 45 lire. Milan: C.E.D.A.M. 10" \times 7". 3 vols.
- Edge (E. W.). Gold and silver in Canada: a survey of Canada's place in the world situation, and an analysis of some of the major operations. Toronto: H. R. Bain and Co., Ltd., 1934. 11" \times 8 $\frac{1}{2}$ ". 67 pp.
- Ekonomista, kwartalnik poświęcony nauce i potrzebom życia organ tow. ekonomistów i statystyków polskich. Rok. XXXIV, Tom II, 1934. Warsaw: 1934. 9 $\frac{1}{2}$ " \times 6". 101 + 7 pp.
- Fortunati (Paolo). Natalità, mortalità e nuzialità dei comuni del Regno in ordine d'intensità di popolazione. Padua: Istituto di Statistica della Regia Università di Padova, 1934. 9 $\frac{1}{2}$ " \times 7". 31 pp.
- Gilboy (Elizabeth W.). Wages in Eighteenth-Century England. Cambridge, Mass.: Harvard University Press (London: Humphrey Milford), 1934. 8 $\frac{1}{2}$ " \times 5 $\frac{1}{2}$ ". xxix + 297 pp. 15s.
- Holmstrom (J. Edwin). Railways and roads in pioneer development overseas: a study of their comparative economics. London: P. S. King, 1934. 8 $\frac{1}{2}$ " \times 5 $\frac{1}{2}$ ". 304 pp. 15s.
- International Institute of Agriculture. The agricultural situation in 1932-33 . . . economic commentary on the *International Yearbook of Agricultural Statistics for 1932-33*. Rome, 1934. 9 $\frac{1}{2}$ " \times 6 $\frac{1}{2}$ ". viii + 580 pp. 25 lire.
- International Statistical Institute. Recueil international de statistiques économiques 1919-1930. The Hague: 1934. 11 $\frac{1}{4}$ " \times 9". 241 pp. 4 florins.
- Irwin (J. O.). Correlation methods in psychology. Cambridge: reprint from the *British Journal of Psychology*, Vol. XXV, Part I. July 1934. 10" \times 7". [6] pp.
- Lasorsa (Giovanni). La fecondità legittima della donna secondo l'età. Padua: C.E.D.A.M., 1934. 9 $\frac{1}{2}$ " \times 6 $\frac{1}{2}$ ". vi + 81 pp. 15 lire.
- Statistica demografica con particolare riferimento alla organizzazione ed alle fonti che la riguardano. Padua: C.E.D.A.M., 1934. 10" \times 7". 249 pp. 35 lire.
- Variazioni stagionali dei fenomeni economici. Rome: reprint from *Economia*, Vol. XIV, Num. I, 1934. 9 $\frac{1}{2}$ " \times 6 $\frac{1}{2}$ ". 22 pp. (From the author.)
- Marbe (Karl). Grundfragen der angewandten Wahrscheinlichkeitsrechnung und theoretischen Statistik. Munich: Verlag C. H. Beck, 1934. 9 $\frac{1}{4}$ " \times 6 $\frac{1}{2}$ ". 177 pp. 8 Rm.
- Mortara (Giorgio). Prospettive economiche. 14th ed. Milan: Università Bocconi, 1934. 10" \times 7". xl + 594 pp. 50 lire.
- Perry-Keene (Addison). Budgetary control: the office taking the reins. Vice-Presidential lecture delivered to the Office Management Association, 1933. 8" \times 5". 14 pp. Commerce: a series of lectures given to the students of the Faculty of Commerce Birmingham University. No. 1, Administration, 9 pp. No. 2, Markets, 8 pp. 1933. 8" \times 5". Money spent for employment, 1933. 8" \times 5". 4 pp. The future, 1933. 8" \times 5". 3 pp. Time is money (reprint from the *Engineer*, Oct. 29th, 1926). 8" \times 5". (From the author.)
- Peters (Harold Edwin). The foreign debt of the Argentine Republic. Baltimore: The Johns Hopkins Press, 1934 (London: Humphrey Milford). 8 $\frac{1}{2}$ " \times 5 $\frac{1}{2}$ ". ix + 186 pp. \$2.

II.—Authors and Miscellaneous—Contd.

- Philographischer Verlag. Konjunkturstatistische Korrespondenz, I Jahrgang, I Heft, Juli 1934. Basel: 1934. $9\frac{1}{2}'' \times 6\frac{1}{2}''$. 28 pp. 10 *cts*.
- Punjab Board of Economic Inquiry. Publication Nos: 32. Farm accounts on the Punjab, 1931-1932. 240 pp. *Rs.* 2. 33. Studies in the cost of production of crops in the Punjab. 121 pp. *Rs.* 1/8. 34. Economics of gut-making in the Punjab. 86 pp. 8 *annas*. 36. Cost of ginning and pressing cotton in the Punjab. 18 pp. 4 *annas*. 37. Economic condition of Simla rickshaw men. 57 pp. 8 *annas*. 38. Finance and marketing of cultivators' wheat in the Punjab. 86 pp. 8 *annas*. Lahore: C. & M. Gazette, 1934. $9\frac{1}{2}'' \times 6\frac{1}{2}''$. (From the Board and Mr. L. R. Dalwar.)
- Robbins (Lionel). The great depression. London: Macmillan, 1934. $8\frac{1}{2}'' \times 5\frac{1}{2}''$. xvi + 239 pp. 8s. 6d.
- Rose (T. G.). Higher control: a manual for company directors, secretaries and accountants. London: Pitman, 1934. $8\frac{1}{2}'' \times 5\frac{1}{2}''$. xvi + 269 pp. 12s. 6d.
- Simonide (S.). Vers l'union douanière et économique des Balkans. Athens: reprint from *Les Balkans*, 1933. $9\frac{1}{2}'' \times 6\frac{1}{2}''$. 63 pp. (From the author.)
- Statistica. Memoirs of the Biometric Laboratory, Nencki Institute and Statistical Laboratory, Central College of Agriculture. Nr. IV. Warsaw: 1934. $11\frac{1}{2}'' \times 8\frac{1}{2}''$. 9 reprints of papers.
- Watson (J. P.). The city real estate tax in Pittsburgh. Pittsburgh: Bureau of Business Research, University of Pittsburgh, 1934. $9'' \times 6''$. 108 pp. (From the Bureau.)
- Wicksell (S. D.). Analytical theory of regression. Lund: Meddelande från Lunds Astronomiska Observatorium, Ser. II, Nr. 69. 1934. $10\frac{1}{2}'' \times 7\frac{1}{2}''$. 32 pp.
- Befolkningsrörelsen i Sveriges härader tingslag och städer 1911-1925 samt i Sveriges bygder 1901-1925. Lund: C. W. K. Gleerup, 1934. $10'' \times 7\frac{1}{2}''$. 135 pp.
- Bidrag till den formella befolkningsteorien med tillämpningar på Norges befolkning. Oslo: reprint from *Statsökonomisk Tidskrift*, 1934, Hette 1-2. $9'' \times 6''$. 94 pp.
- De Svenska universitets- och hogskolestudenternas sociala ursprung och ekonomiska förhållanden. Stockholm: Särtryck ur Medicinska Föreningens Tidskrift, Nr. 2, 1934. $10'' \times 7\frac{1}{2}''$. [9] pp.
- Studentekonomi. Stockholm: Kooperativa Förbundets Bokförlag, 1934. $7\frac{1}{2}'' \times 5\frac{1}{2}''$. 67 pp. 75 *ore*. (From the Statistical Institute, Lund.)
- Wilson (Sir Arnold). Walks and talks: the diary of a Member of Parliament in 1933-34. London: Oxford University Press, 1934. $8\frac{1}{2}'' \times 5\frac{1}{2}''$. xv + 244 pp. 5s.
- Young (Terence). Becontree and Dagenham: a report made for the Pilgrim Trust by Terence Young. London: The Becontree Social Survey Committee, c/o Samuel Sidders & Son, Ltd., 1934. $8\frac{1}{2}'' \times 5\frac{1}{2}''$. 420 pp. 10s. 6d.

PERIODICALS RECEIVED BY THE LIBRARY.

ANNUAL LIST.

In addition to the publications named in the bi-monthly lists, the Society receives the official and other periodicals enumerated below.

(a) United Kingdom and its several Divisions.

National.

United Kingdom—

- Admiralty.* Health of the Navy. Fleets. Navy, Appropriation account, Navy, Dockyard expense accounts.
- Agriculture and Fisheries, Ministry of.* Agricultural market report. Journal of the Ministry of Agriculture. Agricultural statistics. Diseases of animals. Sea Fisheries: Report; Statistical tables.
- Air Ministry.* Appropriation account. Health of Air Force. Progress of civil aviation.
- Charity Commission.* Report.
- Civil Service Commission.* Report.
- Colonial Office.* Annual Colonial reports.
- Control, Board of.* Lunacy and mental deficiency. Report.
- Crown Lands, Office of Commissioners of.* Report.
- Customs and Excise, Commissioners of.* Report.
- Development Commission.* Report.
- Dominions Office.* Report of Overseas Settlement Committee.
- Ecclesiastical Commission.* Report.
- Education, Board of.* Annual report. Health of the school child. Memorandum on Board of Education Estimates.
- Electricity Commission.* Annual report. Engineering and Financial statistics. Generation of electricity.
- Forestry Commission.* Annual report.
- Friendly Societies, Registry of.* Reports of the Chief Registrar. Industrial Assurance Commissioner, Report.
- General Register Office.* Weekly return of births and deaths. Quarterly return of births, deaths and marriages. Registrar-General's statistical review.
- Health, Ministry of.* Accounts of the National Health Insurance Fund. Alkali works, report. Annual report. Costing returns. Local taxation returns. Local rates and rateable value. Poor relief, quarterly statement. State of the public health. Welfare of the blind, Report.
- Home Office.* Aliens Restriction Acts, statistics. Criminal statistics. Report of Chief Inspector of Factories and Workshops. Licensing statistics. Police (Counties and Boroughs), reports of H.M. Inspector. Police, Report of the Commissioner for Metropolis. Prisons and convict prisons. Street accidents, return. Race-course Betting Control Board report. Workmen's compensation statistics.
- Imperial Institute.* Mineral industry statistical summary.
- India Office.* Statistical abstract for British India. Home accounts. Progress and condition of India.
- Inland Revenue, Board of.* Report of Commissioners.
- Labour, Ministry of.* Abstract of labour statistics. Annual report of the Ministry of Labour. Juvenile employment (London) reports. Ministry of Labour Gazette.
- Lord Chancellor's Department.* Civil judicial statistics.

(a) **United Kingdom and its several Divisions—Contd.****United Kingdom—Contd.**

- Medical Research Council.* Report. Industrial Health Research Board, annual report.
- Meteorological Office.* Annual Report of the Director.
- Mines Department.* Annual report of Secretary. Deaths from accidents in mines. Electrical Inspector of Mines, annual statement. List of mines. Miners' welfare fund, report. Safety in Mines Research Board, report.
- Mint, Royal.* Annual report of the Deputy Master and Comptroller.
- National Debt Commissioners.* Local loans fund, accounts, National Health insurance fund and Unemployment insurance fund, account of securities held. Post Office savings banks, accounts. Savings banks and friendly societies, annual account, Trustee savings banks, annual report of the Inspection Committee.
- Overseas Trade, Department of.* Reports.
- Patent Office.* Annual report.
- Pensions, Ministry of.* Annual report.
- Permanent Consultative Committee on Official Statistics.* Guide to current official statistics.
- Post Office.* Commercial accounts. British Broadcasting Corporation annual report.
- Public Trustee Office.* Annual report.
- Public Works Loan Board.* Annual report.
- Queen Anne's Bounty Office.* Annual report.
- Scientific and Industrial Research, Department of.* Annual report. Forests Products Research Board, report. Fuel Research Board, report.
- Trade, Board of.* Annual statement of trade. Bankruptcy. Board of Trade Journal. Companies. Controller of the Clearing Office, report. Foreign trade and commerce, Quarterly accounts. Gas undertakings. Navigation and shipping. Pilotage return. Shipping casualties and deaths on vessels. Statistical abstract for the British Empire. Statistical abstract for the United Kingdom. Trade and navigation, monthly accounts. Weights and measures, annual report.
- Transport, Ministry of.* London and Home Counties Traffic Advisory Committee, annual report. Railway accidents. Railway companies (staff) return. Railway returns. Road Fund, report on administration of. Railway Rates Tribunal, annual report. Tramways and light railways (street and road) returns.
- Treasury.* Appropriation accounts: Civil service, Revenue departments. Civil service, estimates. Consolidated fund, abstract account. Finance accounts. Financial statement. National debt return. Public Departments, gross and net cost. Public social services, return of expenditure. Public income and expenditure. Trading accounts and balance sheets. University Grants Committee, report.
- War Office.* Army appropriation account. General annual report of the British Army. Health of the Army. Territorial Army finances. War Office Library, Annual supplement to subject index.

Municipal and other local returns.

- LONDON COUNTY COUNCIL:** Annual report; Gazette; London statistics; Statistical abstract.
- METROPOLITAN BOROUGHs.** Accounts: Battersea, Islington. Medical Officer of Health, Report: Paddington.
- MUNICIPAL BOROUGHs.** Accounts: Birmingham, Carlisle, Ipswich, Leicester, Liverpool, Manchester, Nottingham, Southgate. Medical Officer of Health, Reports: Birkenhead, Birmingham, Liverpool, Manchester, Wolverhampton.

Scotland—

- Agriculture, Department of.* Annual report. Agricultural statistics. Preliminary returns—Acreage. Produce of crops.
- Control, General Board of.* Lunacy and mental deficiency.

(a) United Kingdom and its several Divisions—*Contd.*Scotland—*Contd.*

- Education Department, Scottish.* Annual reports, combined volume.
Fishery Board for Scotland. Annual report. Statistical tables.
Health, Department of. Annual report. Central Midwives Board, report.
Prisons Department. Annual report. Civil judicial statistics. Criminal statistics.
Registrar-General. Annual report. Births, deaths and marriages: Weekly, Monthly, and Quarterly returns.
Scottish Office. Constabulary, Report of H.M. Inspector. Local taxation returns.
 ABERDEEN. Report of the Medical Officer of Health.
 EDINBURGH. Municipal Accounts.
 GLASGOW. Report of the Medical Officer of Health.

Northern Ireland—

- Agriculture, Ministry of.* Agricultural statistics.
Commerce, Ministry of. Electricity Supply Acts, annual report. Industrial Assurance Commissioner, annual report.
Education, Ministry of. Report.
Finance, Ministry of. Registrar-General's annual report. Quarterly return of marriages, births and deaths. Ulster Year-book.

Miscellaneous Publications.

- Accountant. Accountants' Magazine. Alliance News. Annals of Eugenics. Auctioneers' and Estate Agents' Institute, Journal.
 Banking Almanack. Banker's Magazine. Bank of England, Statistical summary. Barclays Bank Monthly Review. Barclays Bank (Dominion and Overseas) Monthly Trade Cables. Biometrika. Brewers' Almanack and Wine and Spirit Trade Journal. British Association, Report. British Iron and Steel Federation: Statistical bulletin [Monthly]. Statistics [Annual]. British Waterworks Association, Official Circular. Broomhall's Corn Trade Year-book.
 Chamber of Shipping, Annual Report. Chartered Institute of Secretaries, Proceedings, etc. Chartered Surveyors' Institution, Journal. Colliery Guardian. Commercial World. Co-operative Congress, Annual report. Corporation of Foreign Bondholders, report. Cremation Society, Transactions.
 Daily Mail Year-book. Dalgety & Co., annual review.
 East India Association Journal. Economica. Economic Journal. Economist. Eugenics Review.
 Faculty of Actuaries, Transactions and List of Members. Financial Review of Reviews. Fireman.
 Geographical Journal.
 Health and Empire. Hospitals Year-book.
 Incorp. Society of Rating and Valuation Officers, Journal. Illuminating Engineer. Institute of Actuaries, Journal, List of Members, Year-book. Institute of Bankers, Journal. Institute of Chartered Accountants, List of Members. Institution of Civil Engineers, Proceedings, List of Members. Iron and Steel Institute, Journal.
 King Edward's Hospital Fund: Annual Report, Statistical Summary.
 Land and Liberty. Liverpool Cotton Association, Annual and Weekly Circulars. Lloyds Bank Monthly Review. Lloyds Register: Annual Report, Shipbuilding Returns. Wreck Returns. London and Cambridge Economic Service: Monthly Bulletins, and Special Memoranda. London Bankers' Clearing House, Report. London Chamber of Commerce, Journal.
 Mallett's Weekly Wool Chart. Manchester Guardian Commercial; and supplements. Manchester Statistical Society, Transactions. Mersey Docks and Harbour Board, Annual report. Metropolitan Water Board, Annual report. Mining Association of Great Britain Statistical Review of the coal industry. Municipal Year-book.

(a) **United Kingdom and its several Divisions—Contd.***Miscellaneous Publications—Contd.*

- National Association for Prevention of Tuberculosis: Transactions, Report of Council. National Temperance. Nature.
- Peabody Donation Fund, Report of Governors. People's Year-book. Pixley and Abell's Circular. Planning. Population. Post Magazine: Post Magazine Almanack. Public Administration, Journal of. Public Health. Publishers' Circular.
- Quarterly Journal of Mathematics.
- Review of base metal conditions. Review of Economic Studies. Royal Agricultural Society of England, Journal. Royal College of Physicians of London, List of Fellows, etc. Royal College of Surgeons of England, Calendar. Royal Institution, Proceedings. Royal Meteorological Society, Journal and Phenological Report. Royal Sanitary Institute, Journal. Royal Society, Proceedings. Royal Society of Arts, Journal. Royal Society of Edinburgh, Proceedings, Transactions. Rubber Growers' Association, Report.
- Samuel Montagu & Co., Weekly Letter, Annual Bullion Letter. Scottish Chartered Accountants, Official Directory. Secretary. Secretaries' Association, Year-book. Seyd (R.E.), Statistics of failures. Signal. Society of Motor Manufacturers: The Motor Industry of Great Britain. Society of Incorporated Accountants and Auditors, Year-book. South Wales Coal Annual. Statesman's Year-book. Statist. Stock Exchange Gazette. Stock Exchange Year-book.
- Tattersall's cotton trade review [Annual]. Times. Times Literary Supplement. Times Trade and Engineering Supplement. Tin. Tropical Agriculture.
- United Empire. University Calendars: London, University College. Manchester. University College of Wales. Queen's University, Belfast.
- Vacher's Parliamentary Companion.
- Wallis' Index Cotton Circular. Weddel & Co., Annual review of imported dairy produce. Westminster Bank Review. Whitaker's Almanack. Willing's Press Guide. Who's Who.
- Year-book of Learned Societies.

(b) **India, Dominions, and Protectorates.****India—**

- Department of Commercial Intelligence and Statistics.* Agricultural statistics. Indian coal statistics. Monthly statistics of cotton spinning and weaving. Monthly statistics of production in certain selected industries. Review of the trade of India. Sea-borne trade, Annual statement of. Sea-borne trade and navigation. [Monthly.] Sea-borne trade and navigation for the calendar year. Statistical abstract for British India. Statistical tables relating to banks. Trade at stations adjacent to the land frontier routes.
- Department of Industries and Labour.* Annual report of Chief Inspector of Mines.
- Meteorological Office.* Memoirs. Scientific Notes.
- ASSAM. Administration report.
- BENGAL. Administration report. Report on maritime trade.
- BOMBAY. Labour Gazette.
- PUNJAB. Memoirs of the Irrigation Research Institute. Public Health report.
- Annual report of the Indian Chamber of Commerce.
- Indian Journal of Economics.
- Sankhyā, Indian Journal of Statistics.

(b) **India, Dominions, and Protectorates—Contd.****Irish Free State—**

Department of Agriculture. Journal.

Department of Industry and Commerce. Irish trade journal. Statistical abstract. Trade and shipping statistics [Annual]. Trade statistics [Monthly].

Department of Local Government and Public Health. Annual report of the Registrar-General. Quarterly return of the marriages, births and deaths.

Statistical and Social Inquiry Society of Ireland, Journal.

Australia—

Bureau of Census and Statistics. Australian Demography. Finance.

Labour report. Official year book. Oversea trade. Pocket compendium of Australian statistics. Production. Quarterly summary of Australian statistics. Transport and communication.

Department of Health. Health.

Economic record.

New South Wales—

Bureau of Statistics. Official year book. Statesman's year book. Statistical bulletin. Statistical register.

Department of Railways. Report of the Commissioner.

Public Works Department. Report.

Auditor General. Report.

Queensland—

Registrar-General's Office. A B C of Queensland statistics. Agricultural production. Live stock and pastoral production. Statistics of the State of Queensland.

South Australia—

Statistical Office. Statesman's pocket year book. Statistical register.

Tasmania—

Bureau of Census and Statistics. Pocket year book. Statistics of the State of Tasmania.

Report on Government Railways and Ferry Service.

Victoria—

Office of the Government Statist. Victoria year book. Friendly Societies, Report.

Western Australia—

Government Statistician's Department. Pocket year book. Quarterly statistical abstract. Statistical Register.

Department of Mines. Report.

Canada—

Department of Agriculture. Report of the Minister of Agriculture.

Department of Finance. Public accounts.

Department of Labour. Labour gazette. Prices in Canada and other countries. Wages and hours of labour.

Department of Public Works. Report of the Minister of Public Works.

Department of Justice. Annual report of the Superintendent of Penitentiaries.

Dominion Bureau of Statistics. Automobile accidents. Canada year book.

Coal statistics. Education annual survey. Fisheries statistics. Iron and steel industry. Live stock and animal products statistics. Manufactures of non-ferrous metals. Mineral production. Monthly review of business statistics. Railway (steam) statistics. Trade of Canada. [Fiscal year, Calendar year, and Quarterly returns.] Vital statistics.

(b) **India, Dominions and Protectorates—Contd.****Canada—Contd.**

ALBERTA. *Department of Public Health*. Annual report of the Vital Statistics Branch.

ONTARIO. *Department of Agriculture*. Annual reports.

QUEBEC (PROVINCE). Statistical year book.

Canadian Bank of Commerce, Commercial letter; Annual statement.

Royal Bank of Canada, Monthly letters; Annual report.

Ceylon—

Administrative reports. Blue book. Railways (Government) report. Papers laid before Legislative Council. Vital statistics.

Federated Malay States—

F.M.S. Government Gazette; and Supplements. Manual of statistics.

Jamaica—

Vital statistics.

Malaya—

Return of foreign imports and exports [annual and monthly returns]. Malayan statistics.

Mauritius—

Blue Book.

New Zealand—

Census and Statistics Office. Agricultural and pastoral production. External migration. Factory production. Friendly societies and trades unions. Insurance. Justice. Local authorities' handbook. Miscellaneous (Prices, Wages . . . Banking . . . Income and Income tax). Monthly abstract of statistics. New Zealand official year book. Population and buildings. Trade and shipping. Vital statistics.

Auckland Chamber of Commerce, Journal.

Canterbury Chamber of Commerce, Bulletin.

Royal Society of New Zealand, Proceedings.

Wellington Harbour Board, Accounts.

Nigeria—

Trade Supplement to Nigeria Gazette. [Monthly.]

Rhodesia—

Rhodesia Chamber of Mines: annual report, and monthly returns.

Uganda Protectorate—

Blue Book.

Union of South Africa—

Department of Customs and Excise. Annual statement of the trade and shipping. Trade of the Union of South Africa. [Quarterly.]

Department of Mines and Industries. Annual report of the Government Mining Engineer.

Office of Census and Statistics. Official year book. Report of the agricultural and pastoral production. Statistics of migration. Statistics of production. Report on the vital statistics.

(b) **India, Dominions, and Protectorates—Contd.****Union of South Africa—Contd.**

CAPE OF GOOD HOPE. Ordinances.

NATAL. Fisheries report.

Johannesburg Chamber of Commerce. Annual report.

South African journal of economics.

Transvaal Chamber of Mines: annual report, and monthly returns.

Zanzibar—

Statistics of the Zanzibar Protectorate.

(c) **Foreign Countries.****Argentine Republic—**

Dirección General de Estadística. Anuario de comercio exterior. El comercio exterior.

BUENOS AIRES. Rivista de estadística municipal.

BUENOS AIRES (PROVINCE). Boletín de la Dirección General de Estadística.

Economic review.

Revista de ciencias económicas.

Austria—

Bundesamt für Statistik. Statistische Nachrichten. Statistisches Handbuch. *Bundesministerium für Handel und Verkehr.* Statistik des Aussenhandels Österreichs.

Bundesministerium für Land- und Forstwirtschaft zusammengestellt. Statistik der Ernte.

VIENNA. *Statistisches Amt der Stadt.* Statistisches Jahrbuch. Statistisches Taschenbuch.

Monatsberichte des Instituts für Konjunkturforschung.

Belgium—

Ministère de l'Agriculture. Publications de l'Office de Statistique Agricole.

Ministère de l'Industrie et du Travail. Revue du travail.

Ministère des Finances. Bulletin mensuel du commerce (Union Économique Belgo-Luxembourgeoise). Tableau annuel de commerce. (Union Économique Belgo-Luxembourgeoise.)

Statistique Générale. Annuaire statistique. Bulletin trimestriel.

Bulletin de l'Institut des Sciences Économiques.

Brazil—

Departamento Nacional de Estatística. Banking. Foreign trade of Brazil.

Departamento Nacional da Industria e Commercio. Boletim.

Bulgaria—

Direction Générale de la Statistique. Annuaire statistique. Bulletin de statistique. Mouvement de la population. Statistique agricole. Statistique du commerce. Statistique coopérative. Statistique criminelle. Statistique de l'enseignement.

Chile—

Banco Central de Chile. Boletín mensual.

Dirección General de Estadística. Anuario estadístico.

Estadística Chilena. [Monthly.]

SANTIAGO. *Junta Local de Beneficencia.* Anuario estadístico.

(c) Foreign Countries—Contd.

China—

Chinese Maritime Customs. List of lighthouses, light-vessels, etc. Monthly returns of the foreign trade. Trade of China. [Annual.]

National Tariff Commission. Prices and price indexes in Shanghai. Shanghai market prices report.

Ministry of Communications. Report on the Chinese Post Office.

Nankai Institute of Economics: Monthly bulletin on economic China.

Cuba—

Seccion de Estadistica. Comercio exterior.

Czechoslovakia—

Office de Statistique. Annuaire statistique. Manuel statistique. Monthly summary of foreign trade. Rapports. Rapports sur les prix. Revue statistique Tchecoslovaque. Statistique Tchecoslovaque [including annual returns on—Agriculture, Education, Trade, etc.].

PRAGUE. Annuaire statistique. Bulletin mensuel.

Denmark—

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INDEX TO VOL. XCVII.

YEAR 1934.

(Current Notes are indicated by the letters C.N.)

	PAGE
ADDITIONS to the Library	221, 380, 536, 701
AGRICULTURE. Price indices of Agricultural products. (C.N.)	203
in India. See SINHA (H.).	
BANK OF ENGLAND weekly return during 1933	238
BEETON (H. R.) Obituary	693
BOOKS. <i>Reviews of statistical and economic books :</i>	
Abbati (A. H.). Search for confidence in 1932. (C.N.)	528
— Economic readjustment in 1933. (C.N.)	528
Aftalion (A.). L'or et sa distribution mondiale	338
Andersson (W.). Researches into theory of regression	334
Ashton (T. S.). Economic and social investigations in Manchester, 1833-1933	487
Burns (A. F.). Production trends in the U.S.A. since 1870	660
Cahill (Sir R.). Economic conditions in France (D.O.T. Report)	603
Cohen (J. L.). Building Society finance	509
Cole (G. D. H.). Studies in world economics	346
Das deutsche Volkseinkommen	498
Dublin (L. I.). To be or not to be. A study of suicide	183
Durbin (E. F. M.). Purchasing power and trade depression	175
Economic Survey of the Colonial Empire. (C.N.)	690
Economist's Handbook. (C.N.)	689
Edwards (D. S.). Gold reserves and the monetary standard	496
Elbourne (E. T.). Fundamentals of industrial administration	350
Ellis (L. S.). Tariff on sugar	506
Elsas (M. J.). Volkswohlstand und Volkseinkommen	498
Fellner (F. V. de). Communications in the Far East	507
Florence (P. S.). Logic of industrial organization	178
Gluckstadt (H.). Theory of the credit standard	168
— Mechanism of the credit standard	168
Gregory (T. E.). Gold, unemployment, and capitalism	342
Hawtrey (R. G.). Trade depression and the way out	494
Hodson (H. V.). Economics of a changing world	345
Hutton (J. H.). Census of India, 1931, Vol. I.	488
Index-number of securities, 1867-1914. (C.N.)	690
Internationaler Steuerbelastungsvergleich. (C.N.)	628
International trade statistics, 1931 and 1932. (C.N.)	628
— Labour Office. Industrial relations in Great Britain	349
— and Inst. of Agriculture. The rural exodus in Germany	504
Jones (J. H.). Economics of saving	500
Kuczynski (R. R.). Fertility and reproduction	336
Liefmann (R.). Cartels, concerns and trusts	501
Meade (J. E.). Rate of interest in a progressive State	675
New Survey of London Life and Labour	163, 490
Pigou (A. C.). Theory of unemployment	172
Plummer (A.). International combines in modern industry	348
Recueil International de Statistiques Économiques. (C.N.)	690
Renne (R. R.). Tariff on dairy products	506
Répaçi (F. A.). La finanza italiana nel ventennio 1913-1932. (C.N.)	628
Rhodes (E. C.). Elementary statistical methods	337
Risser (R.). Applications de la statistique à la démographie et à la biologie	658
Rist (C.). Essais sur quelques problèmes économiques et monétaires	170
Robbins (L.). The great depression	666
— Nature and significance of economic science	343
Robinson (J.). Economics of imperfect competition	671
Royal Institute of International Affairs. Monetary policy and the depression	166
Schmidt (O. T.). German business cycles, 1924-1933	681
Schultz (T. W.). Tariff on barley, oats and corn	506
Sinha (H.). Early European banking in India	177
Statesman's Year-Book, 1934. (C.N.)	629

Books—Reviews of statistical and economic books—Contd.

	PAGE
Statistical Year Book of the League of Nations, 1933-34. (U.N.) . . .	680
Taxation of foreign and national enterprises. (U.N.) . . .	627
Urwick (L.). Management of to-morrow . . .	178
Venn (J. A.). Foundations of agricultural economics . . .	182
Walker (E. R.). Australia in the world depression . . .	180
Warren (H. F.) and Pearson (F. A.). Prices . . .	165
Wernette (J. P.). Money, business and prices . . .	674
Wilson (Sir A.). Walks and talks . . .	492
Winlett (N.). Australia as producer and trader, 1920-1932 . . .	351
World economic survey, 1932-33. (U.N.) . . .	538
World production and prices. (U.N.) . . .	207
Young (T.). Becontree and Dagenham . . .	665
Zahn (F.). 50 Années de l'Institut International de Statistique . . .	484
Zolotas (X.). L'étalon-or, en théorie et en pratique . . .	169

Other new publications (shorter notices) :

Allen (G. O.). British industries and their organization . . .	353
Ashworth (R.). Structure of business management . . .	676
Bibliography of differential fertility . . .	677
Brookings Institution. A.B.C. of the N.R.A. . . .	510
Buchanan (Sir G.). International co-operation in public health . . .	676
Eysenck (A.). Insecurity : a challenge to America . . .	354
Fegiz (P. L.). La dinamica delle popolazioni . . .	185
Hesinger (E.). Le bois en Europe . . .	185
Int. Labour Office. Studies and reports. Social aspects of rationalization . . .	185
Employment exchanges . . .	510
International survey of social services . . .	510
Johns Hopkins University. School of Hygiene and Public Health. Collected Papers . . .	677
Kingsbury (S. M.) and Fairchild (M.). Employment and unemployment in Soviet Russia . . .	511
Klein (P.) and Voris (R.). Some basic statistics in social work . . .	186
Lorge (I.) and Brunner (R. de S.). American villages : 1930 . . .	511
McCallum (B. D.). Iron and steel industry in the United States . . .	354
McGregor (A. G.). Lasting prosperity . . .	354
Melita (J. K.). Value, classifications and principles of public revenue and expenditure . . .	512
Milward (G. E.). Business man's guide to Management . . .	678
Nat. Bur. of Economic Research. Purchase of medical care through fixed economic payment . . .	354
Panandikar (S. G.). Industrial labour in India . . .	355
Papi (G. U.). Escape from stagnation : an essay on business fluctuations . . .	186
Peters (H. E.). Foreign debt of the Argentine Republic . . .	678
Rau (B. R.). Banks and the money market . . .	187
Robertson (U. J.). World sugar production and consumption . . .	512
Shanghai Bureau of Social Affairs. Strikes and lock-outs in Shanghai since 1918 . . .	512
Spencer (H. R.). Government and politics of Italy . . .	187
Stamp (L. D.) and Beaver (S. H.). The British Isles : geographical and economic survey . . .	513
Wattal (P. K.). Population problem in India . . .	513
BOWLEY (A. L.). Twenty-second session of the International Institute of Statistics . . .	473-477
BRITISH ASSOCIATION. Arrangements for September session. (C.N.) . . .	369
Business activity. Economist index of. See CROWTHER (G.).	
CAMPION (H.). Pre-war fluctuations of Profits in the Cotton-spinning Industry . . .	626, 632
CENSUS OF PRODUCTION, final report. (C.N.) . . .	204, 366
CENTENARY of the Royal Statistical Society . . .	467
CINEMATOGRAFH FILMS. Value of remittances abroad for. See ROWSON (S.).	
COST OF LIVING. See Prices.	
Cotton-Spinning Industry. Pre-war Fluctuations of Profits in. See CAMPION (H.).	
CROWTHER (GEOFFREY). Economist index of Business Activity . . .	241-261
American indices . . .	243
"Economist" index : component series . . .	247
construction of the index . . .	253
Economic fluctuations in Great Britain, 1920-33 . . .	259
Discussion : Mr. Macrosty ; Sir G. Paish ; Mr. Leak ; Mr. Munro ; Dr. Isserlis ; Mr. N. Crump ; Dr. Elsas ; Mr. S. Jevons ; Mr. O'Brien ; Mr. H. Parkinson ; Mr. Crowther in reply . . .	261-276

	PAGE
DALE (J. A.). The Interpretation of the statistics of unemployment	85-101
Turnover of the Live Register	85
Intermittent unemployment	88
Hard core of unemployment	91
Conclusion and Appendix	97
Discussion : Mr. H. Clay; Sir A. Flux; Mr. E. C. Ramsbottom; Mr. C. O. George; Miss Collet; Mr. Reeder; Prof. Greenwood; Mr. S. L. Besso; Mr. Dale in reply	101-113
DISCUSSION on methods used in different countries for estimating national income. Prof. Bowley; Mr. Leak; Mr. Colin Clark; Mr. Macrosty; Prof. Greenwood; Mr. F. W. Paish; Mr. D. W. Walton	541-557
EISLER (ROBERT). International price stability <i>versus</i> exchange stability	478-483
ELDEBERTON (W. PALIN) and HANSMANN (G. H.). Improvement of curves fitted by the method of moments	331-333
ELECTIONS to Fellowship	84, 113, 276, 312, 422, 557, 657
EXCHANGE stability. <i>See</i> EISLER (ROBERT).	
FACTORY INSPECTION. (C.N.)	208
FOREIGN EXCHANGES, 1933 (table)	240
HARPER (SIR EDGAR). Obituary	212
INDIAN agricultural statistics. <i>See</i> SINHA (H.).	
INDIA's trade and industrial statistics. <i>See</i> LINDSAY, Sir H. A. F.	
INDUSTRIAL and Agricultural Research Section, meeting. (C.N.)	370
INTERNATIONAL CONGRESS for Scientific Management. Draft pro- gramme. (C.N.)	690
INSTITUTE of Agriculture, cheese analysis. (C.N.)	369
INSTITUTE of Statistics. <i>See</i> BOWLEY (A. L.).	
INTERPRETATION of the statistics of unemployment. <i>See</i> DALE (J. A.).	
IRWIN (J. O.). Recent advances in mathematical statistics (1932)	114-154
JONES (J. H.). Exchange stability <i>versus</i> internal Price stability	277-299
Discussion : Mr. Hawtrey; Sir B. Blackett; Sir J. Stamp; Mr. Hodson; Mr. Gordon; Mr. Balogh; Prof. Jones in reply	299-312
LINDSAY (SIR H. A. F.). India's trade and industrial statistics, past, present, and future	399-411
Price statistics	408
Appendix	411
Discussion : Dr. Bonar; Mr. S. Jevons; Mr. A. R. Burnett-Hurst; Captain Elliot; Sir C. Kisch; Dr. Sinha; Dr. Heron; Dr. Snow; Sir H. Lindsay in reply	412-422
MABSON (RICHARD R.). (C.N.)	211
MANCHESTER STATISTICAL SOCIETY. Centenary activities. (C.N.)	370
MATHEMATICAL STATISTICS. Recent advances in. <i>See</i> IRWIN (J. O.).	
METHODS used for estimating national income. <i>See</i> STAMP (SIR JOSIAH).	
MILBANK Memorial Fund. Annual report. (C.N.)	211
NATIONAL INCOME, methods used for estimating. <i>See</i> STAMP (SIR JOSIAH).	
Discussion on methods used in different countries for estimating national income	541-557

	PAGE
NEYMAN (JERZY). On the two different aspects of the representative method	558-606
Introductory	558
Mathematical theories underlying the representative method	561
Different aspects of the representative method	567
Comparison of the two methods of sampling	573
Conclusions	585
Appendix	589
Discussion : Prof. Bowley; Dr. E. S. Pearson; Dr. Isserlis; Prof. Fisher; Prof. O. Anderson; Dr. Neyman in reply	607-625
OBITUARY. Henry Ramie Beeton	693
Sir Edgar Harper	212
Richard R. Mabson. (C.N.)	211
OCCUPATIONAL MORTALITY. See YULE (G. UDNY).	
PERIODICALS. Statistical and economic articles in recent periodicals	213, 372, 530, 695
POPULATION problems. International Union for the Scientific Investigation of. (C.N.)	209
Pre-war Fluctuations of Profits in the Cotton-Spinning Industry. See CAMPION (H.).	
PRICES. Price indices of Agricultural products. (C.N.)	203
retail in the United Kingdom and other countries, monthly figures	197, 362, 522, 686
wholesale, monthly figures of Board of Trade, <i>Economist</i> and <i>Statist.</i> (C.N.)	194, 360, 519, 684
Price stability. See EISLER (ROBERT).	
Profits in the Cotton-Spinning Industry, Pre-war Fluctuations of. See CAMPION (H.).	
REPRESENTATIVE METHOD. See NEYMAN (JERZY).	
REVENUE of the United Kingdom (table)	233
ROWSON (S.). Value of remittances abroad for cinematograph films	633 640
ROYAL STATISTICAL SOCIETY centenary	467
Industrial and agricultural research section. (C.N.)	370
SANKHYA. Indian journal of statistics. (C.N.)	210
SINHA (H.). Indian agricultural statistics	155, 162
<i>Statist</i> (Editor of). Wholesale prices of commodities in 1933	313-330
<i>Statist's</i> annual index-numbers	313
Decennial averages 1828-37 to 1924-33	314
Summary of index-numbers, groups of articles 1873, 1896, 1909-33	315
Review of the year	316
Monthly fluctuations since 1888	318
Monthly index-numbers, January 1931-March 1934	319
Quarterly movement of prices	320
Construction of tabular statements	321
Average prices of commodities	322-327
Silver and gold production and prices	328-330
STAMP (SIR JOSIAH). Methods used in different countries for estimating national income	423-455
Scope of the discussion	423
Definitions of national income	424
Rival concepts tested	425
Income method	428
Wages	432
Census proper	435
Inventory estimates—agriculture	439
Duplication problem	442
Causes of differences between the methods	447
Element of capital value	449
Price change element	451
Discussion : Prof. Verrijn-Stuart; Prof. F. Simiand; Sir A. W. Flux; Prof. C. Gini; Sir J. Stamp in reply	455-466
Honorary member of the Hungarian Statistical Society. (C.N.)	529

	PAGE
STOCK EXCHANGE securities, index-numbers of. (C.N.)	196, 361, 521, 686
TRADE. Comparative annual tables, 1931-32-33	231, 389
—— of the United Kingdom. (C.N.)	188, 356, 515, 680
—— of India. <i>See</i> LINDSAY, SIR H. A. F.	
—— DISPUTES in the United Kingdom. (C.N.)	199
TWO DIFFERENT ASPECTS of the representative method. <i>See</i> NEYMAN (JERZY).	
UNEMPLOYMENT, Interpretation of statistics of. <i>See</i> DALE (J. A.). —— in Great Britain and other countries. (C.N.)	200, 363, 523, 687
VITAL STATISTICS, England and Wales, Scotland, Northern Ireland, Irish Free State	391-398
—— <i>See</i> YULE (G. UDNY).	
WAGES. Average level of wage-rates. (C.N.)	199
YULE (G. UDNY). On some points relating to vital statistics, more especially statistics of occupational mortality	1-72
Standardization	1
Standard errors of comparative mortality, figures	26
Appendix. Tables of occupational mortality	61
Discussion: Prof. Greenwood; Dr. Stocks; Mr. Derrick; Dr. Isserlis; Mr. D. Walton; Mr. Yule in reply	73-84

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